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CHEMICAL AGE

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US CHEMICAL TRENDS

RETURNS for the first quarter of this year show that the US chemical industry spent only $340 million as against an estimated $428 million. Spending in the second quarter is now put at $372 million compared with an earlier estimate of $415 million. Looking to the third quarter it has been expected that something like $346 million would be spent for expansion.

Estimates at the end of 1957 suggested that $1.6 billion would be spent by US chemical industry or only 6 per cent less than the 1957 figure. Now, however, the figure is put at $1.4 billion or 14 per cent lower than last year's figure. It seems quite certain now that the outlook in the US for new plant and equipment is much less bright. All the major industry groups, except public utilities, are planning to spend less this year than last. During the last three months there has been a heavy cutback in spending estimates. Indeed all manufacturing is down 25 per cent from 1957.

This information, gleaned from a joint Commerce Department—Securities and Exchange Commission survey, carried out during late April and May, gives no forecast for US capital spending in all sections of industry in the fourth quarter. As total spending for this year is put at $30.7 billion, there are some US observers who believe that the $30.3 billion annual rate for the third quarter shows that the decline may be levelling off. But having regard to the previous optimistic estimates and the actual falls which have occurred, there are many who are less enthusiastic.

According to the Department of Commerce, who have produced seasonally adjusted chemical sales figures since last October, April sales in the chemical industry after making seasonal allowances, showed a 5 per cent gain from March and stood at $1.83 billion. In April sales fell by 4 per cent and were 9 per cent below those during last summer's peak period. Chemical companies' inventories were down, however, at $3.83 billion, showing the first decrease since October.

During May, chemicals and pharmaceutical stock has been included in the 'short' selling on the New York Stock Exchange, but on the whole prices are continuing steady. Companies concerned here were Du Pont, Dow Chemical, Abbott Laboratories, Merck, National Lead, Commercial Solvents and Minnesota Mining and Manufacturing. Of 12 leading chemical and pharmaceutical companies, selling prices of six rose and the remainder declined.

Dow Chemical, in fact, have announced the laying-off of 600 salaried employees by September. Indeed, lay-offs began last month. This action has become necessary, the company reports, in facing present economic conditions with realism.

At the same time the US is concerned with growing competition abroad. Pharmaceutical and drug exports by Britain are understood to be worrying US pharmaceutical houses. Petrochemical expansion in Great Britain, in Germany and France is also a major US consideration.

To cite one example, last week, Chemische Werke Hüls reported that work at Bunawerke Hüls GmbH., on the cold rubber (butadiene-styrene low temperature copolymer) plant is so far advanced that experimental trials have begun. Improvements in the polymerisation process made over the last two years have made it possible to produce 70,000 tons of cold rubber using the

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same plant capacity which was originally to produce 45,000. This year alone, Bunawerke plan to make 30,000 tons of rubber.

This synthetic rubber project has been guaranteed assistance by the West German rubber industry through a loss equalisation guarantee of DM 10 million a year for the first five years of operation (production being at 45,000 tons a year). At this output costing in butane of about DM 0.24 per kg. ex-refinery—roughly 2½ times the price in the US—gives a price for Hüls rubber of DM 2.70 per kg., delivered consumer. US cold rubber at present costs DM 2.45 f.o.b., Hamburg. With an output of 90,000 to 100,000 tons a year, the German price would fall to DM 2.40-2.45. It is now obvious from the news of the increased production capacity that the price will soon be less than the US exported price, without a subsidy.

Vinyl chloride exports from Italy now total 70,000 tons a year. These are expected to increase shortly when Societá Chimica Ravenna starts production.

France has considerable plans for petrochemical production. A $300-million petrochemicals expansion programme is under way which is estimated to cut out $40 million a year of sulphur imports, the greater part from the US. At the same time France will soon be a large exporter of sulphur, coming second to the US. Large plants are now going up for butyl rubber (20,000 tons a year) and carbon black (40,000 tons a year).

A large increase in French aluminium capacity (70 per cent increase over the next two years), is also planned. Last year 159,000 metric tons of aluminium were produced; output is expected to be 275,000 tons by 1960, with a further increase by 1966 to 365,000 tons, with about 80,000 tons for export. In the US there is news of reduction in aluminium outputs.

Regarding the effect of US trade with the rest of the world, during the first quarter this year US balance of payments resulted in an outflow of $550 million in gold and dollars to the rest of the world. Exports were 20 per cent less than in the same period last year, but imports remained almost steady. This situation is different from the other US recession periods when the value of imports from the rest of the world fell by an annual rate of 14 per cent. But how long the present trend will continue and how big a dollar loss there will be for the rest of the world should a reversal of this pattern occur is under study.

It is expected that US imports may fall by an annual rate of about $2,000 million with a probable decline in the total supply of US dollars of about $3,000 million. Western Europe and the sterling area are believed to be in a better position to withstand the present US recession. Reasons advanced for this are that a large proportion of Western Europe's dollar supplies does not come from exports to the US, but from services. At the same time there is in being a long-term upward trend in European exports to the US which should offset recessionary movements. Imports which are likely to be affected by the recession, are those of raw materials, particularly ores. To some extent, the part the US plays in world trade has been over-emphasised and even exaggerated. Last year, total world imports were valued at more than $105,000 million of which the US purchased $13,000 million. The countries of Western Europe, however, took nearly $47,000 million, and the European colonies and outer sterling area, $16,000 million.

A NEW SUCROSE DERIVATIVE

WORKING with the compact sucrose molecule with its unique combination of a 5- and a 6-member oxygen-containing ring, Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co. US, have prepared dozens of sucrose derivatives each of which has been thoroughly evaluated in a variety of applications. One of these derivatives, sucrose acetate isobutyrate (or SAIB), has evidenced such promise that Eastman has commenced commercial production.

Sucrose acetate isobutyrate is formed by the esterification of sucrose with the unusual combination of acetic anhydride and isobutyric anhydride. The result is an extremely viscous (100,000 cps. at 30°C) clear liquid of high molecular weight (847) with excellent stability and wide compatibility with most resins, film formers, and plasticisers. Its characteristics are reported to be so unlike any known product that difficulty is found in classifying its performance.

Incorporated into coating formulations its behaviour is described as intermediate between a resin and a plasticiser. Its extreme solubility is indicated by the low viscosity, approximately 700 cps. at room temperature, of 90 parts of SAIB in 10 parts of ethyl alcohol, as compared to its undiluted viscosity 100,000 cps. It is in solution with ethyl alcohol, identified as SAIB-90, that Eastman plan to market this new product; the undiluted form will also be available.

As an example of its ability to extend solvent coating formulations, Eastman instance the solids content of a lacquer system based on ½ sec. RS nitrocellulose which can be increased from 20 per cent non-volatile to 33 per cent by replacing one half of the nitrocellulose with SAIB with no increase in viscosity and no decrease in film hardness. Thus it is claimed that greater surface area coverage per gallon of lacquer can be achieved with reduced solvent requirements. In addition to extending the solids content of solvent coatings, improvement in adhesion of many coatings has been noted.

Ability of SAIB to extend the solids content of lacquer formulations with no loss in film hardness has been demonstrated. Sward hardness of nitrocellulose films plasticised with castor oil and with dibutyl phthalate has been compared with films containing SAIB and it was noted that the hardness of films containing SAIB increases up to 25 per cent modification, returning to the hardness of the unmodified film at 50 per cent modification. Hardness of films containing castor oil, on the other hand, does not change up to 25 per cent modification and decreases rapidly beyond this point. Dibutyl phthalate causes an immediate and rapid reduction in sward hardness. Films containing as much as 80 per cent SAIB and 20 per cent nitrocellulose have been found to exhibit reasonable hardness characteristics.

Because of the high degree of compatibility of SAIB with resin and film formers its use in hot melts has been studied. Cellulose acetate butyrate melts, for instance, have been produced containing as much as 70 per cent of the sucrose ester without becoming tacky. Because of its high boiling point (over 550°F), fuming at melt temperatures in the neighbourhood of 350°F is virtually non-existent.

Among the various type coatings in which SAIB has been evaluated are wood lacquers, paper coatings, cloth coatings, metal lacquers, plastic lacquers, hot melt coatings, and peelable plastic coatings.

SAIB modified plastic lacquers with high non-volatile contents have been formulated which are said to show good adhesion to a variety of plastics. Hot melt coatings prepared from SAIB and half-second butyrate with only small amounts of a polymeric plasticiser have been prepared, which are tough and flexible at 25°F, have good adhesion to paper and are not tacky. Colour retention is claimed to be excellent even after 24 hours at 350°F. An absence of fuming at this temperature is one of the outstanding characteristics of SAIB modified hot-melt formulations. Peelable plastic coatings based on cellulose acetate butyrate and SAIB have been formulated which exhibit excellent resistance to exudation.

Other unusual properties of SAIB include its rapid decrease in viscosity with slight increases in temperature. From 30°C to 50°C, for instance, its viscosity drops from 100,000 to 4,800 cps. At 100°C the viscosity of SAIB is only 86 cps. Its hydrolysis stability is excellent and its solubility in water at 25°C is less than 0.1 per cent.

CRL Urged to Expand Research on High Purity Chemicals

Marked Advances in Radiochemical and Polymer Fields Referred to in 1957 Report

EXPANSION of the present programme of inorganic chemistry, particularly for research on high-purity materials, is urged by the Chemistry Research Board, in its 'Annual report for 1957'. (Published for DSIR by HMSO price 5s (90 cents US) by post 5s 6d).

The report, which is presented to the Council for Scientific and Industrial Research, recommends that plans for the next five-year period (1959-64) should include the provision of buildings, equipment and staff for greater effort in these and other directions.

The new unit established at Harwell under the Director of the Chemical Research Laboratory, to collaborate with the UK Atomic Energy Authority on research with particular regard to the applications of isotopes to the work of other DSIR laboratories and of the grant-aided research associations, has made a preliminary survey of the problems awaiting attack.

Larger Extraction Programme

As the UK AEA's programme extraction of radioactive elements from minerals and ores is to be extended, the Authority have agreed to extend the radiochemical building and to increase the number of staff engaged on its behalf.

Corrosion of Metals. Tracer studies on steel have enabled the mechanism of inhibition by chromates, benzoates and nitriles to be better understood. First step on immersion of the steel is the formation of an adsorbed layer of the inhibitive anion on the surface which suppresses the anodic and/or cathodic reactions constituting corrosion. 'Logarithmic' oxide film growth then proceeds underneath the adsorbed layer by a mechanism analogous to that of oxide film growth in air at room temperature. This continues as long as the adsorbed layer is present. In the absence of sufficient inhibitor logarithmic growth reverts to a system of anodes and cathodes, with accompanying corrosion. Film growth in chromate solution is able to enhance the degree of protection, as shown from 'electrode potential decay' studies.

Work on inhibitors for abraded mild steel in distilled water has been extended. Main groups of compounds under test are (1) sodium salts of substituted benzoic acid and related acids, and (2) chromate, nitrite, benzoate, sodium hydroxide (in order of decreasing effectiveness). In group (1) the *o*-substituted benzoates are less efficient than the corresponding m- and *p*-compounds. (Substituents -NO_2, -Br, -Cl). Sodium *o*-nitrohydrocinnamate has proved more effective than any of the substituted benzoates or even chromate protecting at a concentration of 21 p.p.m.

Tests on the CRL inhibitive mixture (1.5 per cent sodium benzoate/0.1 per cent sodium nitrite in tapwater) in the absence of ethylene glycol, daily heated to 80°C and at room temperature have shown that corrosion of all metals commonly found in automobile systems is greatly reduced.

During the past year, more interest has been aroused in the use of *cyclo*-hexylamine carbonate (CHC) to protect the fire side of boilers during idle periods. Laboratory tests on the value of CHC in preventing corrosion of mild steel covered with scrapings from glue-ways and exposed to a relative humidity of 84 per cent, showed that the overall corrosion rate was lowered but a pitting attack was caused, which could be dangerous in boiler equipment.

Separation of rare earths. Work begun earlier on a beneficiation technique has been continued. Using a 'didymium oxide' containing 75 per cent Nd_2O_3 and minor quantities of Sm_2O_3 and Pr_6O_{11}, it was found that under suitable conditions the bulk of the samarium was concentrated into the first third of the eluate, the centre fraction contained an enriched neodymium while the final portion gave a praseodymium concentrate. Beneficiation appeared to be favoured by a low lanthanon load on the column or by an eluant of low pH.

Yttrium Oxide

Similar experiments have been carried out with a 'yttrium oxide' containing about 25 per cent of heavy earths. The heavy earths from lutetium to erbium were concentrated in the first third of the eluate. The method has proved useful as a preliminary to the separation process and has been operated successfully on a scale employing 500 grammes of mixed lanthanons.

An improved modification is now used for loading the ion-exchange columns. The lanthanon load is approximately 12.5 per cent of the column capacity while the solution employed for loading contains lanthanon, ammonium and hydrogen ions. The ammonium to lanthanon ratio of the solution is adjusted so that the first part of the column receives an approximately 50 per cent lanthanon load (e.g. solution which is 0.9N in ammonium and 0.1N in lanthanon ions). The ratio of ammonium to hydrogen ions in the eluate has to be higher than those of the original eluant. In a light-earth separation the major component (neodymium) contains about one per cent of praseodymium. With the heavier rare earths better separations are obtained with ethylenediamine tetra-acetic acid than with nitrilotriacetic acid. With 'yttrium oxide' the elements from lutetium to thulium were concentrated in the first 10 per cent of the eluate.

Thirty kilogrammes of 'yttrium oxide' containing approximately 25 per cent of heavy earths, have been processed by the mixed-loading method, using nitrilotriacetic acid as eluant. Modifications in loading technique and eluant composition have improved the concentration of heavy earths obtained. Concentration of the elements lutetium to erbium has been increased in the head fractions by factors of from 3 to 9. These head fractions were combined and fractionated again to increase the concentrations of rare earths. Products obtained were loaded onto single ion-exchange columns in the hydrogen form and eluted with citric acid. Head fractions, mainly ytterbium, thulium and erbium, were given additional treatments on smaller columns of fine particle size resin. Ytterbium, thulium and erbium oxides of 99.9 per cent were isolated.

Recovery of Germanium

Studies on the recovery of germanium from a synthetic ammoniacal liquor by co-precipitation with metal sulphides and/or hydroxides has been extended to samples of liquors from gas works. For a sample from South Eastern Gas Board which contained much sulphide as well as 3.2 p.p.m. of germanium, zinc sulphate was the most successful additive, 72 per cent of the germanium being recovered by filtering off the precipitate after standing for 2 hours. With addition of a coagulating agent, standing time could be reduced to ½ hour; 66 per cent of the germanium was recovered by filtering and 58 per cent by decanting of the liquid after that time. With a sample containing much less sulphide (2.5 p.p.m. germanium) zinc sulphate was not so successful.

Best recovery was with ferric sulphate, 70 per cent, filtration being carried out after half an hour. A mixture of zinc sulphate and ferric sulphate gave quite good recoveries with the liquors, particularly if the ferric sulphate was added about 5 minutes after the zinc sulphate. A 75 per cent recovery of germanium was obtained with SE Gas Board sample and

59 per cent with the other liquor.

Liquor from the Fuel Research Station (1.4 p.p.m. germanium) containing some sulphide and much organic matter gave, after removal of organic matter and treatment with zinc sulphate, very little germanium until ammonium sulphide was added, when 67 per cent recovery was achieved.

Radiochemicals. Advances have been made with resin-in-pulp and solvent-extraction processes for the extraction and recovery of uranium and thorium from ores.

Recent work on recovery of uranium from sulphate solutions by solvent extraction has shown that with leach liquors high in ferric iron it is impossible to extract 99 per cent of the uranium without co-extracting at least 20 per cent of the ferric iron present. Since ferrous iron was not extracted by any of the materials studied, previous reduction of the ferric ion by addition of iron filings to the acid liquor was found largely to overcome the trouble. With phosphate-bearing leach liquors, the reduction process can lead to precipitation, probably as uranous phosphate, of as much as 3 per cent of the uranium.

Kerosine Extractants

Extraction of uranium from sulphate liquors using kerosine solutions of various secondary and tertiary amines of high molecular weight has been examined. Advantage of this type of extractant over the phosphate esters is that preliminary reduction of the ferric ion is not necessary. A disadvantage is that amine-kerosine solvents frequently require the addition of a third substance such as a high molecular weight alcohol to prevent third phase formation and to improve solvent extraction generally. Impurities in the amines can be removed by converting the amine to the SO_4/HSO_4 form by treating with normal H_2SO_4 and washing with very dilute acid. Uranium is removed from the amine by NaCl -H_2SO_4 solution. The progress of this work has been hindered by the scarcity of suitable amines commercially available in the UK.

Investigations have been carried out on the possibility of recovering thorium from sulphuric acid monazite leach liquors by selective oxalate precipitation. Bench scale experiments have resulted in a method giving 90-95 per cent recovery and a product containing virtually no phosphate and a thorium/rare earth weight ratio of 5 : 1. Precipitation is effected by the addition of a 100 per cent stoichiometric excess of oxalic acid to diluted leach liquor containing 12 to 14 per cent v/v H_2SO_4. To obtain a high purity product, fresh H_2SO_4 solution must be used to digest the precipitate.

Work on the recovery of gold as reported in last year's report has continued with a view to obtaining a theoretical interpretation of previous observations.

An ion-exchange phosphorylated cellulose has been developed for the recovery of thorium. The carbonate complexes formed by 10 per cent ammonium carbonate used as eluant, are decomposed by boiling the eluate to give a product which after ignition contained 90 per cent ThO_2 and only 3 per cent rare earth oxides.

A rapid field method for estimation of uranium in river water has been developed. Dibenzoyl methane is added to the water as a solution in aqueous pyridine containing EDTA. The resulting complex is extracted in carbon tetrachloride and the colour compared with a set of standards. The pyridine serves both as solvent for the dibenzoyl methane and as a buffering agent to produce the optimum pH for development of maximum colour intensity. EDTA is present to complex interfering metal ions. As little as 10μg./l. of uranium can be detected.

A method has also been developed for the estimation of traces of lead and zinc in river water, requiring only simple apparatus. It can be operated by non-scientific personnel. As little as 0.5μg. Pb or 0.2μg. Zn per millilitre of water can be readily determined. A sample of water is pipetted onto a Whatman's ashless tablet or E17 paper and sprayed with an acetone-water solution of dithizone. Zinc forms an intensely crimson-coloured dithizonate and may be estimated directly by visual comparison with a set of standards. The dithizonate of lead is brick-red but for a given amount of metal is much less strongly coloured than that of zinc. To estimate lead in presence of zinc the latter should be washed by addition of potassium ferrocyanide.

Organic Intermediates. Increased effort on truly selective ion-exchange resins has permitted several new sources of chelating and complexing resins to be examined.

For extraction of uranium from dilute solutions, resins derived from resorcinol-arsonic acid have proved to be more efficient than other arsonic acid resins; e.g. those derived from polyaminostyrene by the Bart reaction. Evidence accumulated suggests that the chelating behaviour of the resorcinol-arsenic acid resins depends upon the association of a phenolic group in the ortho-position to the arsonic group. Thus, methylation of the phenolic groups in the resin results in a lower order of uranium capacities.

Novel Polymers

Novel polymers containing the hydrazine group in various forms, -NH-NH_2, -NH-NH- and -N(NH_2)- have been prepared by two different approaches. The first involves incorporation of hydrazine groups into preformed polymers. The other relies on syntheses based on polymerisation and condensation reactions. In addition N-substituted polymeric hydrazines and polymers containing the hydrazine group have been prepared.

In the synthetic approach polymeric hydrazines have also been prepared by condensation of hydrazine and related compounds with alkylene dihalides. Ethylene dichloride and unsymmetrical dimethylhydrazine give a mixture of a crystalline derivative and linear polymer, it is reported. The former has been identified as ethylene *bis*-dimethyl hydrazinium dichloride. This reacts further with ethylene dichloride to yield the polymer which has been characterised as the picrate. Hydrazine also reacts with epichlorhydrin to give polymeric materials.

Members of a series formed by heating dihydrazides of aliphatic dicarboxylic acids are of interest as fibre-forming polymers. Work on the structure of the hydrazide polymers is in progress. They have been found to exhibit marked reducing and chelating properties.

N-β-chloroethyl- and N-vinyl-oxazolid-2-one have been prepared. On heating at 200°C, the β-hydroxyethyl derivative initially affords a water-soluble, tacky, rubber-like polymer. When heating is continued up to 240°C, some cross-linking occurs yielding a rubbery gel which swells considerably in water.

Study of Boron

A programme of work on the chemistry and applications of organo-metallic and organo-metalloid compounds has been initiated. Certain aspects of the organic chemistry of boron have been selected for immediate study.

High Polymers. With support of the National Research Development Corporation, work on ion selective membranes has been intensified.

Results show that sulphonated polyvinyl chloride membranes exhibit highly permselective behaviour in alkaline solutions over a wide range of current densities. With neutral sodium sulphate solution and with sulphuric acid solutions the efficiency was also over 90 per cent at a current density of 25 mA/cm^2. Membranes from unplasticised p.v.c. were very brittle and resistance was too high (over 1,500 ohm./cm.^{2}) for the membrane to be of value. Satisfactory membranes were more easily obtained by the use of plasticised film.

Preliminary experiments have shown that weakly basic anion-exchange membranes can be prepared by the reaction of ethylene diamine with p.v.c. or with vinyl chloride-vinyl acetate copolymer. Weakly basic membranes obtained have been treated with dimethyl sulphate to produce strongly basic materials.

Research on the preparation and properties of cation-exchange membranes of the heterogeneous type has continued, and the effect of resin content and the degree of cross-linking of the resin on the electrochemical properties of the membranes has been investigated. The membranes were made by moulding mixtures of polyethylene and finely divided sulphonated polystyrene resins (*Chemistry Research* 1955, p. 57).

It is suggested that paper chromatography would appear to be an elegant means of determining molecular weight distributions of polymers, since in principle it should be possible to measure both the concentration of polymeric material in any small section of a paper strip and the corresponding concentration of end-groups. A successful fractionation of samples of polysarcosine dimethylamide of molecular weights up to 12,000

has been accomplished by means of paper-strip chromatography. Best results were obtained by gradient elution, a good solvent being pumped steadily into a reservoir of poor solvent from which ascending development took place. 14C-labelled polymer was employed to provide a convenient means of assessing the chromatograms.

Investigation of fractionation of concentrated polystyrene solutions into numerous fractions having a reasonable weight using membranes has continued. Attempts are also being made to effect fractionation of concentrated polymer solutions by formation of a coacervate phase. Both methods are showing promise. A further development in fractionation with methoxymethyl nylon membranes has been the construction of a new apparatus. A totally enclosed system has been built, in which the volume of both solvent and solution compartments are fixed (100 ml. and 300 ml. respectively), both are stirred electromagnetically and a vertical capillary from the upper solution side permits observation of changes of osmotic pressure during fractionation. Dilution of the solution by passage of solvent across the membrane is prevented.

Microbial production of sulphur. Pilot-plant trials of the microbial production of sulphur from sulphate-enriched sewage sludge being carried out by London County Council at their Northern Outfall Works at Beckton, have confirmed earlier laboratory experiments in that the final sludge 'de-waters' more efficiently than sludge digested for methane.

For stripping of sulphide from fermenting sludge a new technique has been devised. It is based on the common practice of mixing digesting (methane) sludges by continuous circulation through an outside pipe, and involves stripping H_2S from the sludge while it is passing through this exterior column. On a laboratory scale it was found that at 30°C and 40°C, H_2S was removed at least as efficiently as by the old method; higher temperatures are being tested.

This method, if successful, would simplify the design of plant and improve the efficiency of H_2S recovery on the larger scale, while the heat required to keep the fermenting sludge at 30°C could be applied at the stripping column to assist release of H_2S. The method will be tested on the pilot plant for its suitability on the proposed semi-scale plant.

Experiments concerning combined methane-sulphide fermentation have shown that this process involves much greater loss of sulphide in the discarded final sludge. It was concluded, therefore, that it was uneconomic and experiments have been discontinued.

Olympia Firm says 'Results Fine, Will Show at Next Exhibition'

LAST-MINUTE survey of a number of stands at the Chemical and Petroleum Engineering Exhibition which closed at Olympia last Saturday showed that most exhibitors interviewed were more than pleased with their results. As stated in CHEMICAL AGE last week (p. 1195) after a disappointing start as far as attendance was concerned, there was a definite improvement on 24 and 25 June. The busiest days seem to have been the last two days before closing, 26 and 27 June. Actual attendance figures at the exhibition have not been published.

Doubtless the symposium on the 'Organisation of Chemical Engineering Projects', held during the last week of the exhibition, helped attendance figures, for more than 600 home and overseas delegates registered for it either with the Institution of Chemical Engineers or the Institute of Petroleum.

Our survey of the stands showed that the quality of enquiries made was high and most exhibitors expect that firm orders will result in due course.

The director of one large fertiliser firm who visited Olympia on the day before closing said that if his company had realised what a first-class exhibition it was many more of their executives would have made a point of attending. He was greatly impressed by the many new developments shown and by the high quality of the displays. This view was echoed by many other visitors spoken to by CHEMICAL AGE.

In particular, the party of Soviet engineers who attended on a number of days (see CHEMICAL AGE, 21 June, p. 1153, and 28 June, p. 1195) were most impressed with what they saw. In an exclusive interview with CHEMICAL AGE, one of the party, Mr. V. G. Stangei, chief engineer for refineries in the Ufa region, said the visit had been extremely useful. He would have liked more USSR engineers to have seen the show and suggested that UK chemical and petroleum equipment manufacturers should take a small exhibition to Moscow. This would, he declared, be an unqualified success, resulting in the placing of many orders.

From 17 Nations

The Soviet party also visited the stand of Le Grand Rochester Ltd. They were Mr. Ailanian, Mr. A. R. Adamski (KTO), Mr. P. K. Saparov, interpreter, and Mr. L. Nakhimoff who led the party. They collected details of the supply and despatch position, prices and manufacturing details. Another Communist country represented among visitors was Rumania. Within the first three days of the exhibition, Le Grand's had received visitors from 17 countries, including Mexico, Lebanon, Trinidad, the US, Argentina, Colombia, Venezuela, France, Holland and West Germany.

The company received firm orders placed on behalf of Portuguese West Africa. They were extremely satisfied with the results and take the view that when the next exhibition of this kind takes place in four years' time, the business resulting from the 1958 show would justify participation again. That view was also expressed by Mr. Kenneth Preston, chairman of the Platt group when he visited this stand.

Of the 600 visitors to the stand of 'Chemical Age' nearly 200 recorded their votes in our 'polythene-polyethylene' poll (see 'Chemical Age', 21 June, p. 1153). Results of this poll and a selection of the letters received in connection with our offer of two £10 prizes for the best reasons for preferring each name, will be published in 'Chemical Age' next week. Last date for receipt of letters is Monday, 7 July.

CHEMICAL AGE INDEX

With this week's issue of 'Chemical Age', readers will receive our index for Vol. 78 (July-December 1957). As will be seen this index has grown enormously in recent years. This expansion of contents, coupled with rising costs of production, compel us, regrettably, to make a charge for all future indexes.

This charge will be 5s for each index, or 10s for a complete year. Readers who wish to receive copies of the index in future should complete the form that has been mailed to them this week and return it as soon as possible. Remittances should accompany the form; cheques, money orders or postal orders should be crossed and made out to 'Chemical Age'. Overseas readers should instruct their banks to make payment to the Midland Bank London, for account of Benn Brothers Ltd. (Chemical Age).

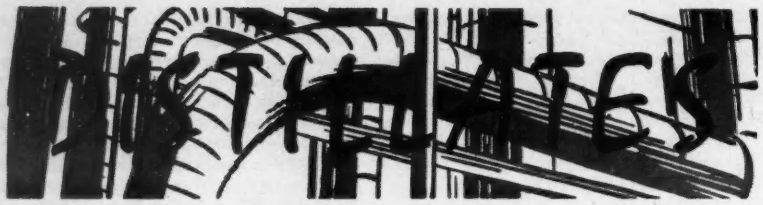
New A & W Bright Nickel Plating Process

FROM 1 July, Albright and Wilson (Mfg) Ltd. marketed a new process for bright nickel plating. This process was originally developed in the US by the Hanson-Van Winkle-Munning Co., where it is known as Nickel-Lume, and Levelume. Albright and Wilson have applied for registration of the name Plusbrite, for the process.

New to the UK this process is said to combine with a fully bright finish better physical properties of the plate than have hitherto been available here.

The deposit is claimed to have good levelling properties and a good degree of ductility. It is of a white colour which is also highly receptive to subsequent chromium plating operations where necessary. Close chemical control of the plating bath is possible.

Data sheets are available from 1 Knightsbridge Green, London SW1.



★ CONSIDERABLE reorganisation of handling methods in a new pharmaceutical factory, the products of which go to five associate companies, has led to a higher degree of efficiency at Winthrop Laboratories Ltd., Fawdon, Newcastle-upon-Tyne. Key to this greater efficiency is a well-planned palletisation programme. This is described in the June issue of *Target*, the productivity bulletin published by the Central Office of Information.

A standard 48 in. by 40 in. pallet has been adopted which gives perfect unit load with complete pallet coverage on all main products, utilises the UK lorry width (7 ft. 6 in.), is sufficiently large to stack to 19 ft. high in separate pillars and yet remain stable, and is not too large for manhandling. In the interests of economy freshly sawn wood is used for pallets; it is about half the price of fully seasoned timber. To overcome a tendency to bend under a load and dry out in that position, pallets are bought at least three months before use and stacked to season in the warehouses. Losses due to splits on drying are 1-1,000.

Co-operation with suppliers has led to savings in raw materials handling. The handling of tartaric acid, for example, was simplified by changing from 112 lb. bags to 56 lb. bags, as the smaller bag bonds and stacks well on a flat pallet.

★ 'THE rare earths stand on the brink of a useful future,' says Dr. Richard C. Himes, a specialist in rare earths research at Battelle Memorial Institute, Columbus, Ohio. Writing in the June issue of the *Battelle Technical Review*, he describes current and future research that 'will make these chemical elements significant materials in many products and processes'.

Current enthusiasm over the rare earths as industrial materials stems from the new-found feasibility of large-scale production, according to Dr. Himes. To illustrate how improved methods for obtaining rare earths have affected their price, he compares 1948 prices with 1958 ones for a number of these materials. As an example, the price of cerium metal has fallen from $50 a pound to $24 in the past ten years. But despite cost reductions, the cost of individual rare-earth elements and compounds is still high in terms of industrial chemicals.

'This matter of cost creates something of a dilemma. Cost cannot be much further reduced until large-scale demands develop, and demands are not likely to rise significantly until prices come down. However, there is one possible point at which this vicious circle may be broken,' suggested Dr. Himes. At present the cost of processing a group of the materials must, in many cases, be borne by income from sale of one component for which demand exists. If more balanced uses of the rare earths (in the proportion of their occurrence in the ore processed) can be developed, eventually they may all become available at quite reasonable prices, as each carries its share of the processing cost.

Considerable effort is now being expended in this direction. Dr. Himes mentions a few areas in which research to increase demand is now in progress.

★ ALMOST every sector of the chemical industry has contributed to the amazing proliferation of new processes and techniques which, now taken for granted, were not even envisaged before the last war. Many of the most important current products of the Albright and Wilson group come in this category. A new three-colour booklet entitled 'Facts about Albright and Wilson' says that while this is evidence of the group's leadership in its own field, 'it makes forecasting of future developments speculative'.

This demand for new chemical products and processes will obviously continue and it is stated 'it is equally certain that the group is big enough and has the scientific and technical resources to meet this challenge successfully'.

Singled out for special mention in this booklet, which is also available in a German edition, are Albright and Wilson (Mfg.) Ltd., major UK producers of phosphorus and its derivatives, who have plants at Oldbury, Widnes, Stratford, Kirkby and Portishead; Marchon Products; and Midland Silicones, Europe's largest producers of silicones.

★ AS A railways enthusiast, I was particularly glad to see that the July issue of the British Transport Commission's *Transport Age* includes a special article on scientific research. This deals with the big contribution that scientists are making to railway modernisation.

Not enough for my liking is said about the chemical research, although the author, Mr. J. M. Beskine, does give some information about its organisation. The chemical and allied services divisions are differently organised and have a two-layer set-up: specialist laboratories in various parts of the country and area chemical laboratories, many of which have specialist sections carrying out research assignments alongside routine work. Headquarters are in London in the office of the assistant director of chemical services.

The corrosion and protective coatings laboratories and the main textiles division laboratory are housed at Cavendish House Laboratories, Derby. Nearby in Calvert Street, is the Derby area chemical laboratory. The disinfestation and weed-killing services have their headquarters at Manchester. Area chemical laboratories are located at Ashford (Kent), Crewe, Darlington, Doncaster, Glasgow, Horwich and Swindon.

London is served by a unit at Stonebridge Park, which is shortly to be transferred to modern premises to be built at Alexandra Palace as part of the department's expansion programme. The new establishment will also do much consultative work and will accommodate the chemical research team dealing with building materials.

★ TO ENABLE the Water Research Association to continue its basic research uninterrupted and at the same time follow up lines which offer immediate practical results, application has been made to the Department of Scientific and Industrial Research for a grant. Although the WRA hopes to receive a generous contribution it will probably have to appeal to members to raise the association's income.

The aim is to exploit fully the increased research facilities which the WRA council have purchased at Medmenham, on the Thames between Henley and Marlow.

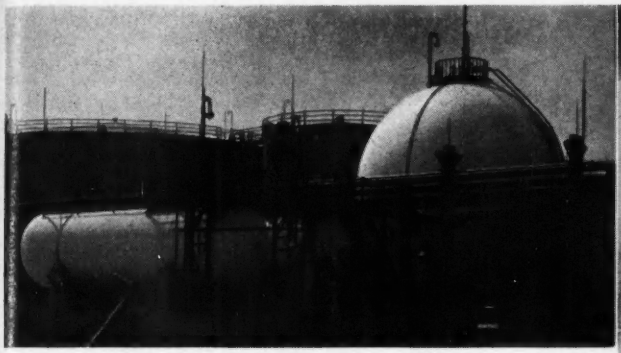
The potentialities for the scientific development of the water industry are vastly greater than can be realised by the association with its present limited funds, inadequate space, insufficient staff and lack of pilot plant facilities.

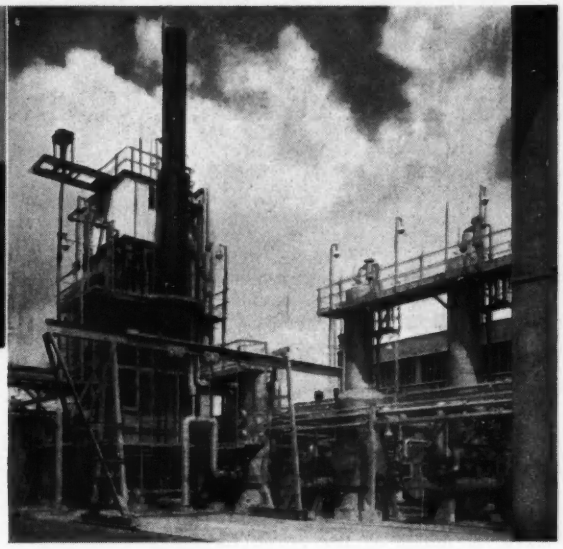
The three fields of investigation so far adopted by the WRA are chemical coagulation in water purification, leak detection and the use of plastics pipes in the water industry. In view of the expansion programme envisaged, the paper presented by Dr. R. G. Allen, WRA director, at the annual conference this week of the British Waterworks Association is of particular interest.

★ A SUBSTANTIAL beneficiary of Achema is the Max-Buchner Research Foundation which has received a cheque for DM 250,000. This grant represents research contributions made by exhibitors who subscribed DM 5 per sq. metre of floor space and 10 per cent of the fees paid by visitors.

Dechema, of Frankfurt who organised the exhibition and the European Congress of Chemical Engineering held in conjunction with it, tell me that the number registered for the whole period of the congress and exhibition totalled 15,000, plus 4,300 students, of which about 60 per cent came from a total of 53 countries. More than 80,000 visitors are said to have attended for shorter periods.

Alembic





Hydrogen storage tank (above) with general view (right) of the Power-Gas Hercules Plant

P-G Hercules Hydrogen Plant for Stork works

A POWER-GAS Hercules hydrogen plant, rated at 24,000 s.c.f.h., is incorporated in the new hardening plant at the Stork margarine works of Van den Berghs and Jurgens Ltd., Purfleet, Essex, which was officially opened on 26 June by Mr. J. A. Connel, a director of Unilever Ltd. This plant produces highly pure hydrogen from propane, using the Hercules reforming furnace.

The plant consists of four main parts: (a) reforming furnace, (b) CO conversion and CO_2 removal, (c) CO conversion to CH_4, and (d) compression, drying and storage. The final gas is guaranteed by Power-Gas to contain not more than 0.1 per cent carbon dioxide, 10 p.p.m. carbon monoxide and 0.5 per cent methane. In practice, say Van den Berghs, these impurities have been found to be present to a much lower concentration.

Propane is received by road from Shell Haven refinery and is transferred to two 25-ton storage vessels. Before feeding to the reforming furnace it is vaporised by hot condensate and passed through activated carbon drums to remove any residual sulphur compounds.

Reforming Process Uses Nickel Catalyst

The hydrocarbon feed is mixed with steam and reformed inside four nickel catalyst-filled special stainless steel tubes. These tubes are enclosed in a furnace heated by ten burners in individual combustion chambers giving an 'oven' temperature of over 1,600°F. Gas oil is used as fuel at present but facilities for heavier oils up to 3,000 secs. Redwood No. 1 viscosity are provided.

Gas produced in the tubes will contain about 20 per cent CO and is cooled with condensate from the amine reboiler and steam. The saturated gas then passes through a vessel containing an iron oxide CO conversion catalyst and the CO converted to CO_2, extra hydrogen being made in the process. The CO_2 is then removed by scrubbing the gas with a solution of monoethanolamine in water. The gas then undergoes a further stage of CO conversion and CO_2 removal. The amine solution is regenerated by boiling and recirculated, first to the second stage CO_2 absorber, then to the first stage CO_2 absorber, then regenerated.

Last traces of CO in the hydrogen are reacted to CH_4 over a Ni-catalyst at approximately 250°C.

The makers have stated that the life of the reforming catalyst can vary but should be not less than two years, though most probably a longer life will be obtained in practice. This has been the case in other plants.

The CO conversion catalyst should have a life of at least three years, whilst it can be reasonably assumed that the methanation catalyst will last at least one year.

Wiggins Dry-type Gasholder

Hydrogen leaving the methanators is cooled to about the ambient temperature, permitting removal of moisture, and compressed from 17-in. water gauge to 90 p.s.i.g. by two-stage vertical compressors. A Wiggins dry-type gasholder of 7,500 cu. ft. capacity is connected to the outlet from the purification train providing buffer storage and automatic control of compressors. The high pressure hydrogen, after Freon refrigerated cooling for maximum moisture removal, is stored in a 32 ft. 6 in. diameter Hortonsphere supplying the hardening plant.

To maintain the temperature of the reforming and purification sections of the hydrogen plant at week-ends, recirculation is employed, the necessary steam for this and for essential heating in the hardening plant being supplied from an automatic oil-fired boiler of 3,300 lb./hr. evaporation. This avoids the need to maintain steam supply for these purposes only from the main boilers.

The plant, which has been designed to produce approximately 60,000 tons of hardened oils per year, consists of six 18-ton hydrogenation vessels together with the associated filter presses, catalyst handling equipment and the necessary weighbridges, tanks, pumps, vacuum plant, heat exchangers and other ancillary plant.

To permit the economic operation of this installation, additional crude oil storage was necessary and in consequence a new tank park with a capacity of 30,000 tons was built adjacent to the hardening plant.

The hydrogenation vessels are equipped with agitators and provision for adding catalyst, the presence of which is necessary for the reaction to take place. The mixture of oil and catalyst is subjected to vacuum from stage ejector systems allowing de-aeration of the charge prior to hydrogenation.

During de-aeration the first stage in the heating of the charge with steam is carried out, after which the hydrogen is admitted. Hydrogenation proceeds rapidly, the exothermic heat liberated raising the charge to the operating temperature. This temperature is then maintained by means of hot water which is pumped through the coils and produces low pressure steam.

Catalyst Removal for Re-use

After cooling to 100°C the hardened oil and catalyst is pumped via the centre point system to any of eight 500-sq. ft. filter presses for removal of catalyst. The clear oil is then pumped to any of twelve 18-ton hardened oil storage tanks from which it is weighed before pumping to the refinery.

After cleaning the filter presses the oil/catalyst cake is dropped on to a scraper conveyor system and transferred to one of eight 3.6 ton re-use catalyst vessels or, if the activity has sufficiently deteriorated, via a reject conveyor to drums for re-activation.

At present the plant is reported to be running at about 90 per cent of capacity. Maximum production achieved in one week was 1,350 tons.

Stream Pollution Control is Best Effected by 'Consent Procedure' says ABCM

THE most realistic method for achieving control of stream pollution is, considers the Association of British Chemical Manufacturers, by use of the consent procedure under section 7 of the Rivers (Prevention of Pollution) Act, 1951. On this basis conditions of consent would be laid down by the river board for the individual circumstances of the particular effluent and part of the stream into which it is or would be discharged.

This was stated by Mr. G. T. King, ABCM technical executive officer and secretary of the association's trade effluents committee, in his paper entitled 'Chemical manufacturers and standards for trade effluents' presented at a symposium last week on 'The control of river pollution'. This was held in conjunction with the annual conference at Southport of the Institute of Sewage Purification.

River boards may make by-laws for any stream or part of a stream under the Act. There are two distinct types of standards possible for by-laws. These are 'effluent standards' and 'stream standards'. By-laws based on effluent standards would presumably apply to all effluents discharged at any point along the whole stream from head waters to tidal limit (or part of the stream concerned). Main objection to this type of standard is that it would be inflexible. For example, it is likely to be based on drought conditions and would therefore tend to require the provision of excessive margins of safety for the stream, to the ultimate hardship of the local authorities in the disposal of sewage and to industry which has to dispose of large volumes of trade effluent.

Varying Conditions

Mr. King pointed out that uniform legislation of any nature was desirable only when it could be applied to uniform conditions. Conditions of effluent and stream, however, would vary in each case. Without adequate stream surveys, the application of arbitrary standards might well lead to large sums being spent without achieving the desired improvement in the quality of stream water.

On the other hand, stream standards would permit full use to be made of self-purification processes and within reasonable limits advantage should be taken of the natural capacity of streams to absorb and purify effluents. The essential basis for stream standards is a stream survey. Having carried out the survey, there were two alternative methods of control. The first was that adopted by the Trent River Board as an alternative assessment of the quality of a discharge by allowing it to be judged by its effect on the water in a stream at any point between 100 and 150 yards downstream of the point of entry of the discharge.

The other was the principle of 'step-loading' as used for radioactive discharges into the Thames. Here the criterion is the safeguarding of drinking water supplies. The level of radioactivity into the Thames has been set for discharges from Harwell, Aldermaston, Amersham and elsewhere on the basis of step-loading of radioactivity. The amount of radioactivity which may safely be added from each additional discharge has been calculated from the general level of radioactivity in the stream at the point concerned.

In each of these two cases, the essential feature was the effect of that particular discharge on the condition of the river at the point of outfall.

So far as chemical effluents are concerned, the disposal of some of their constituents must rely on dilution, e.g. inorganic salts. If there was sufficient reduction of a constituent by dilution together with rapid dispersal some potentially toxic material might be discharged without detriment. Other chemical effluents might affect the receiving waters in many ways, depending on the nature of the effluent and the stream conditions. In an appendix to his paper, Mr. King commented on the effect of certain constituents of chemical effluents.

Arbitrary Control Would be Ineffective

Before a satisfactory chemical standard can be laid down, a proper knowledge of the true effects in a stream of all possible sources of pollution would be needed. Mr. King submitted that control by means of arbitrary limits of concentration of impurities, applicable to all effluents, without regard to the dilution factor, the nature and circumstances of the receiving stream and the improvement in the wholesomeness in the stream which it is intended to achieve, would be either ineffective or economically impracticable.

The paramount factor for the establishment of a stream standard is the weight of polluting matter discharged and not merely the concentration of the effluent. If the concentration were the sole criterion a works employing a reuse of water would be at a disadvantage with another works of similar size employing no such economy and allowing the wasted water to dilute the effluent.

No river board has yet made effluent by-laws, but most have published 'working standards' in their annual reports. These generally are based on the recommendations of the Royal Commission on Sewage Disposal (eighth report, 1912) and they provide a useful guide to the way in which river boards will consider applications for consent to new discharges. These standards, however, are only a guide and the conditions which they prescribe are relaxed or strengthened by the board when appropriate. These recommendations and those of the ninth report (1915) were both made when the chemical industry was in its infancy.

Since the first world war, the industry has grown to become one of the largest industrial users of water in this country and needs about 970 million gallons of water a day from all sources. If the present rate of the industry's expansion continues, 50 per cent more water will be needed in 1966 unless substantial economies can be achieved by recirculation or unless processes can be developed which use less water.

Dealing with methods of analysis, Mr. King said that much progress has been made in the preparation of methods of analysis for sewage and trade effluents. The Ministry of Housing and Local Government has issued a revised edition of 'Chemical Analysis as Applied to Sewage and Sewage Effluents', which refers to a limited number of tests suitable for trade effluents. In 1954, ABCM took the initiative in setting up a joint committee with the Society for Analytical Chemistry to prepare recommended methods of analysis. So far 35 methods have been published in *The Analyst*. A further six methods and an appendix will be ready shortly and the complete series will be published as a book. It is hoped that the methods will commend themselves to river boards and industry generally.

ABCM Accepts Ministry Test Procedure

ABCM has accepted the principle set out in the Ministry circular 8/54 that the assessment of the quality of an effluent should be based on the results obtained from one or more simple tests. This method should be applied to the control of effluents under the consent procedure but such tests would not be adequate for the full control of chemical trade effluents. Further tests for specific constituents would be needed and the controlling authority and the manufacturer should agree on the analytical methods to be adopted to avoid conflicting results.

Mr. King referred to the fact that on a collective basis, the association has recently guaranteed for a number of years a substantial share of the cost of a joint Government/industry scheme of research into the self-purification of streams and unit trade effluent treatment processes. This scheme, which is being supervised by a sub-committee of the DSIR Water Pollution Research Board is about to be started by the Water Pollution Research Laboratory.

The need for the most flexible type of standard is vital to the chemical industry, particularly as chemical producers are constantly introducing new products or adopting new processes, Mr. King declared. One river board and one industry have already co-operated in carrying out a survey to establish limits for the discharge of effluents. This, he said, was an example of the ideal way of meeting the problem and one that could well be extended

Analytical Review

INORGANIC ANALYSIS IN ORGANIC MEDIA

ONE of the features of many recently developed methods of inorganic analysis which can scarcely escape the notice of even the most casual observer is the increasing use which is being made of organic solvents. The use of these solvents is probably more widespread than is generally realised, but much of the information has not yet found its way into the various journals because of security regulations associated with atomic research work.

These solvents are used in many ways, e.g. for suppressing the aqueous solubility of precipitates (water-miscible solvents), for inorganic chromatography, for extraction (water-immiscible solvents), for non-aqueous titration, for flame photometry. The first-mentioned procedure is probably the oldest of these, but chronologically, solvent extraction must be a close rival. The determination of inorganic substances other than acids by non-aqueous titration is perhaps the most recent development.

Extraction of Chloro-complexes by Tri-iso-octylamine in Xylene

In a recent article in this series, the application of some long chain alkylamines to solvent-extraction problems was considered (1). More recent work from the same source has made available some details of the extractive separation of uranium and plutonium from other elements and from each other using this type of reagent (2). Tertiary amines such as di-*n*-octylmethylamine are capable of extracting metals such as vanadium V, chromium VI, plutonium, uranium, etc., from aqueous solutions where they exist as anions or anionic complexes.

The separation of thorium and uranium, both of which may be constituents of fuel elements in atomic reactors, is made easy by this method since thorium, unlike uranium, does not form anionic chloride complexes and is therefore not easily extracted by solutions of these amines in water-immiscible solvents. Using a 5 per cent solution of tri-*iso*-octylamine in xylene, Moore (2) has shown that at hydrochloric acid concentrations greater than about 5 M, extraction of uranium VI is quantitative, whereas thorium remains in the aqueous phase whether or not uranium is present. Indeed, the method offers the possibility of extracting nearly all those elements which form reasonably stable chloro-complexes, *viz.*, iron III, cobalt II, zinc II, zirconium IV, hafnium IV, vanadium V, niobium V, protactinium V, chromium VI, molybdenum VI, uranium VI and IV, plutonium VI and IV and neptunium VI, V and IV.

Inside this group, selective action is possible by control of acidity. Thus the extraction of zirconium is negligible below 6 M HCl and niobium behaves similarly (< 2 M). Ruthenium extracts well, but less than 1 per cent of the original Ru-106 followed uranium through the extraction and stripping operations.

The extraction of iron, vanadium and chromium is suppressed by previous reduction of these ions to lower valency states. Other fission products such as strontium and the trivalent rare earths do not extract appreciably at any concentration of hydrochloric acid. The behaviour of plutonium III is similar to europium III, whereas the hexavalent and quadrivalent forms resemble niobium V and uranium IV respectively in their action. Thus a separation of uranium and plutonium is possible by maintaining the latter in the tervalent form.

By
T. S. WEST, Ph.D.

In modern analytical practice increasing use is being made of inorganic reactions carried out in *organic* solvents. This article features some recent examples which concern

1. Extractive separation of cations by tri-*iso*-octylamine in xylene.

2. Photometric titration of zinc in a benzene-methanol medium.

3. Development of an absorptiometric method for chromium VI following extraction by tri-*n*-octyl phosphine oxide.

Most solvent extraction work within atomic energy establishments is concerned with tracer amounts of material, but Moore *loc. cit.* has carried out the interesting experiment of extending his observations into the 'macro' region. Thus the extraction of 1–2 mg. per ml. quantities of uranium VI from even quite dilute hydrochloric acid (4 M) was found to proceed efficiently and rapidly with equal phase volumes of aqueous solution and 5 per cent reagent in xylene. A tendency for a three-phase system (oil or gel in xylene layer) to be formed with higher concentrations of uranium (about 4–12 mg. per ml.) could be prevented by using higher concentrations of aqueous hydrochloric acid or of reagent in xylene or by adding acetone to the aqueous phase.

The use of solvents of a more polar nature than xylene was also favourable. Thus, taking most of these factors into consideration, it was found that in the range 60 mg. per ml. of uranium, a good extraction, both with respect to efficiency and phase behaviour, was obtained from 9 M hydrochloric acid using 20 per cent tri-*iso*-octylamine in methyl *iso* butyl ketone.

The tri-*iso*-octylamine reagent used in these studies is said to be relatively inexpensive and readily available. The exact structure of the octyl groups in the reagent is not known, but it was thought to be a mixture of dimethyl-hexyl and trimethyl-pentyl, with the branched chain beginning at least two carbon atoms beyond the amino nitrogen atoms in each case.

Non-aqueous Titration of Zinc in Benzene-Methanol

The non-aqueous titration of acids and bases in various solvents is now well known and accepted. It is, however, also possible to titrate metals in organic solvents though few examples are yet known. One recently described method has shown how various chelating agents can be used in the non-aqueous acid-base titration of metals such as cobalt, copper and nickel (3). Chelating agents are essentially acids, and in chelate formation protons are displaced from the organic molecule and may therefore be titrated alkalimetrically. The medium used was a 1:4 methanol/benzene. However, it is usually necessary to use a buffer with such reagents and this cannot be tolerated in the above procedure so that the practical application of this technique is limited. In a more recent paper (4) the colorimetric titration of zinc in benzene-methanol and subsequently in lubricating oils was reported. In this method the zinc was titrated in a medium of benzene saturated with ammonium acetate and containing about 4 per cent methanol with a standard reagent solution of 0.05 per cent dithizone in benzene. The appearance of free, i.e. uncomplexed, dithizone at the end-point was detected by plotting absorbancy at 640 mμ against titre. Alkali and alkaline earth metals present in lubricating oils did not interfere, whilst lead and mercury were the only other heavy metals to behave as zinc. The authors comment that the titration procedure must not be used indiscriminately since in many oil additives the zinc may be at least as strongly complexed as in zinc dithizonate.

This method also underlines the determination of metal ions directly in non-aqueous solvents and although the actual procedure is closely related to conventional colorimetry—which has been practised for a long time now in organic media—this is an obvious point of departure and one may confidently expect further developments along somewhat different lines.

Extraction with Tri-n-octylphosphine Oxide

Tri-*n*-octylphosphine oxide (TOPO) (5) in benzene extracts chromium VI from solutions of several common mineral acids in concentrations from 1–10 M. It is not possible to ascertain the full extractive behaviour of the TOPO system from the paper by Mann and White (6) since the extraction is subservient to the subsequent absorptiometric determination by means

of diphenylcarbazide of the extracted chromium in the organic extract. Unfortunately, it is not easy to obtain access to the earlier paper. It would appear, however, that the favourable extraction persists to a much higher acidity than the optimum value for application of the colour reaction.

The reaction is not complete for concentrations of hydrochloric acid less than 1 M, but the efficiency of the colour reaction of the diphenylcarbazide system falls off when the aqueous concentration of this acid exceeds 2 M. Sulphuric acid gives optimum results with 1 M solution but extraction is obviously also complete at much higher concentrations. In nitric acid the extraction itself is interfered with as a result of reduction of Cr VI possibly by nitrogen oxides.

A similar, though less marked effect was noted with perchloric acid. The presence of additional sulphate ion in sulphuric acid adversely affected the recovery of chromium, but here it is not possible to say definitely from the evidence presented whether or not this was due to interference with the extraction itself. Chloride ion had no such effect. The equilibration between the aqueous and TOPO phases was rapid (1 min.).

This application of colorimetry directly in the organic phase following extractive separation is interesting because an additional reagent has been added to the solvent to develop the colour *in situ*. The measurement of adsorption of an extracted *coloured* complex, e.g. dithizonates, is, of course, well known, but normally it is customary to redistribute a non-highly coloured extracted species into aqueous solution before applying colorimetry. It is to be expected that many more procedures involving production of colours directly in solvent extracts from aqueous solution will be forthcoming.

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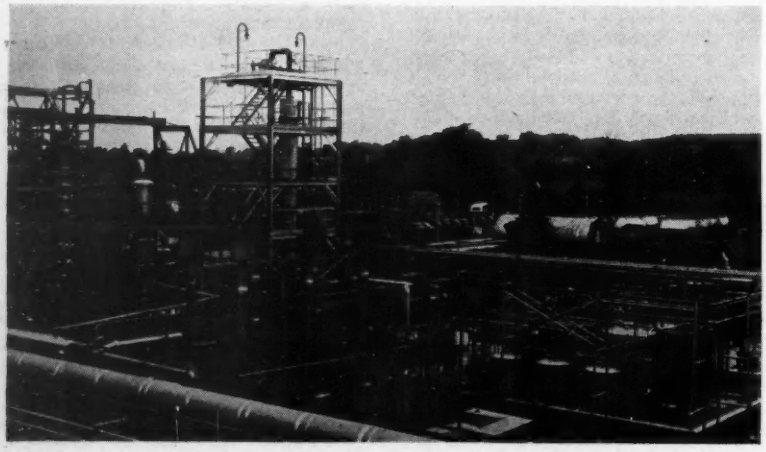
New Separation Plant at Bexford's Film Base Works

A NEW liquid-liquid separation plant for the extraction of ketone hydrocarbon azeotropes had its first trial run last week at the £2½ million film base factory of Bexford Ltd. The plant, part of a large solvent recovery system, is believed to be the first of its kind in the UK. Perfection of the technique called for two years' research work by the company. The plant was constructed by W. J. Fraser and Co. Ltd., Romford.

When a CHEMICAL AGE staff reporter last week visited the factory, the only one of its kind in the Commonwealth, the first run was being carried out by Fraser engineers. At the same time, solvent analysis was being conducted on a Griffin and George vapour phase chromatograph.

As stated last week in 'Distillates', Bexford Ltd. was formed after consultations between Ilford Ltd. and BX Plastics, in which the Distillers Co. Ltd. have an interest, in 1946 to help break dependence on imported film base. The factory which was built on marshland is still expanding; the builders have in fact never left the site since work was first started. The most recent building to be completed is an extension to the laboratories, which provides greater space for pilot plant and chemical engineering studies.

It is only recently that parties of visitors have been invited to the factory. Basic materials for the photographic film base comprise a mixture of cellulose triacetate 'flake', a solvent and a plasticiser, such as triphenyl phosphate. Solvent and plasticiser are varied according to the nature of the base to be made. Methylene chloride, supplied by ICI, is the main solvent used. Triphenyl phosphate plasticiser comes from Geigy.



The new separation unit towers above the solvent recovery plants

Initially cellulose triacetate was imported from the US. Except for a small quantity imported from Belgium, the bulk of the material now used is taken from Lancashire. The quality is said to be better than the best supplies received from the US.

The 'dope' prepared from the three basic materials is loaded into a stainless steel mixer, and is then pumped through a heater to dry off dissolved air. It is next driven under pressure through a filtering medium, from which the viscous dope passes to a stainless steel storage tank. It then passes through a pumping assembly to a spreader from which it is extruded in a fine layer on to the specially-prepared surface of an endless copper band.

The operation is totally enclosed in a heated casting enclosure and here the original solvent is extracted by condensation and the liquid dope becomes a solid film layer. Solvent recovery is important due to the cost of the material; an efficiency of 95 per cent is claimed for the condensation and carbon recovery processes used. In the case of the casting machine, the solvent is sucked through a refrigerator plant, the partially stripped air being purified and later recycled to the plant. To prevent escape of solvent, the casting cabinet is maintained under slight suction by fans that deliver air, containing a small amount of residual solvent, to large carbon adsorber plants in which solvents are recovered, purified and later re-used.

This highly automated plant is operated continuously. Because the industry is new to this country, most of the process and engineering know-how here had to be acquired through experience. The equipment used is designed by Bexford staff and in many cases is installed and maintained by them.

The laboratories have also had to devise some novel apparatus to handle the strict controls that are vital since some film base must be no more than 0.0001 in. thick, must have strong tear strength, must not curl or buckle. In addition, manufacture has to be carried out in dust-free and controlled-temperature conditions. Many of the properties called for in special film base are imparted by extremely fine surface coatings, the nature of which is a well-kept secret.

On the research and development side, work is constantly going on to find a raw material with better properties than cellulose triacetate. Economics play an important part in this work. Currently under study are the condensation polymers such as nylon and Terylene. It is stressed, however, that this is long-term research and that a successor to cellulose triacetate is not expected to be available commercially for some time.

Chilean Party Visit Staffs Glassware Works

Led by Professor Gustavo Pizarro and sponsored by the National Union of Students, a party of 16 Chilean chemical engineers visited the Staffordshire works of Quickfit and Quartz Ltd. last week. Previously they had been to the factory at Fenton, Stoke-on-Trent, of Q.V.F. Ltd.

Overseas News

DU PONT FILES SUIT AGAINST PHILLIPS FOR POLYETHYLENE INFRINGEMENT

Extended negotiations between Du Pont and Phillips in the US on alleged patent infringement of Du Pont's polyethylene patent and licence arrangements (see CHEMICAL AGE, 11 January p. 86) have broken down. Du Pont is to sue Phillips for infringement.

An injunction is being asked for by Du Pont against Phillips' continued manufacture and sale of low-pressure polyethylene. Du Ponts' composition of matter patent issued last year forms the basis of the suit.

Companies involved in the infringement are Phillips and Ziegler licensees who include Celanese, Grace, Union Carbide, Hercules Powder and Koppers, all with completed plants. As licensees, however, they should be protected from damages in original agreements.

Du Pont say that they are still prepared to make licence deals with any plastics manufacturer. The company also has been considering plans for its own major commercial plant to be set up at Laplace, La.

Up to now Phillips has believed Du Pont's patent to be invalid and not infringed.

A court decision is not expected for some time.

Chemical Pharmaceutical Factory for Sicily

A large chemical-pharmaceutical factory is being planned at Trapani, Sicily. The new factory is to produce bromine, magnesium, iodine, vitamins and tartaric substances, etc., utilising such locally available products as algae, water from salines, and residues from processing of fish and wine.

Sales Monopoly to be Registered for German Potash

Potash producers in the German Federal Republic have applied to the authorities for registration of Gemeinschaft deutscher Kalierzeuger (GdK) under the new cartel legislation. Members of the association are all West German potash producers. Under their cartel agreement they undertake to market their entire output of crude potash salts, potash fertiliser salts, potash magnesia, potash chloride, potash sulphate and potash magnesia sulphate through the GdK. The agreement applies to both the home market and exports, and deliveries to domestic users are to be carried out under uniform conditions as regards supply and payment. Participation in total sales by individual members is in accordance with a quota system: Wintershall and Burbach 49.1 per cent, Salzdetfurth and Bergwerksgesellschaft Maria Glück 34.5 per cent, Kalichemie AG 11.4 per cent, Gewerkschaften Baden and Markgräfler five per cent.

Last year the West German potash industry supplied 21 per cent of the total world production of about 8,000,000 tons (K_2O), and 45 per cent of the output was exported.

Burma Bans Imports of Some Pharmaceuticals

Among a list of nearly 97 pharmaceutical items imports of which can no longer be made into Burma under open general licence No. 1, are: calcium lactate; compound tablets of acetylsalicylic acid; phenobarbitone; compound tablets of codeine; tablets of sodium bromide, potassium bromide, soda mint, sodium salicylate; injections of dextrose, and ascorbic acid.

Rumania Buys Synthetic Fibre Plant in W. Germany

A contract for a complete synthetic fibre plant valued at DM 13 million (over £1 million) has been placed by the Rumanian Government with Hans J. Zimmer, a Frankfurt firm. Mihail Florescu, Rumanian Minister for the Oil and Chemical Industries, stated on a visit to Germany that his country was greatly interested in buying plant for the chemical and petroleum industries. Three chemical plants for synthetic fibres, fertilisers, agricultural chemicals, and plastics processing valued at a total of DM 45 million were to be obtained from the Federal Republic this year, and it was intended to buy plant for a synthetic rubber factory with a capacity of 50,000 tons a year. Two fertiliser factories were being built in Rumania at present with Soviet help. The German chemical industry, he stated, had declared its willingness not only to supply equipment but also to issue production licences.

Canadian Chemical Company's Share Deal

It has been announced that 600,000 shares of $1 par value common stock of Jefferson Lake Petrochemicals of Canada are to be offered. Half of the stock is to be offered in Canada and the other half in the US. Offering price in Canada will be $5.50 a share. The US price will be adjusted in accordance with prevailing exchange differential.

Jefferson Lake Petrochemicals of Canada, formed by Jefferson Lake Sulphur Co., New Orleans, US, acquires a sulphur inventory and all fixed assets and the business in Canada of Jefferson Lake Sulphur Co. These include a sulphur plant with a capacity of 300 long tons daily in the Peace River area of British Columbia and natural gas leaseholds interests in 80,000 acres in the Calgary area of Alberta. The company plans to build a second Canadian gas processing plant at Calgary probably in about two years and has a preliminary agreement with West Coast Transmission Co. for joint construction and operation of plants in the Savanna Creek area of Alberta. Longer range plans include production of oil and gas, as well as sulphur and condensates, and eventually petrochemicals.

Dutch Soda Factory Opens

The great 300-million guilder soda factories at Delfzijl, Holland, hailed by the Dutch press as a milestone in Holland's national economy, have been opened by HM Queen Juliana.

Annual production of the new works is to be 170,000 tons of soda, from 5 to 6 per cent of the West European output of this chemical, 23,000 tons of chloride, 300,000 tons of salt and 26,000 tons of nitric acid. The factory has, in fact, been operating since last autumn.

The installation consists of three production centres: the soda factory, the salt electrolysis plant, and the salt plant. About 90,000 tons of the annual soda production are earmarked for the home market. The factory will provide employment for the growing industrial population of East Groningen, and means that Holland's basic chemical production is now self-supporting.

German Experimental Potash Plant in Jordan

Work on an experimental potash factory on the north shore of the Dead Sea has begun by the West German company, Chemiehan. The final agreement between the Arab Potash Co. and the German Company is reported as having been signed.

The factory will have a capacity for producing five tons of potash every eight hours. It is expected that the factory will be completed within six months. The experiments to be conducted at this factory are expected to lead to the designing of a larger factory.

Butadiene for Chemische Werke Hüls

First of three shipments of butadiene destined for Chemische Werke Hüls, Recklinghausen, Germany, has been shipped by Texas Butadiene and Chemical Inc. This shipment of 700,000 gallons will be used at Chemische Werke's jointly-owned synthetic rubber factory, Buna Werke Hüls.

Spain Reports Cheaper Uranium Ore Extraction Process

An official announcement in the Madrid Press states that a new and simplified method of extracting uranium ore has been discovered. Evolved by Spanish Nuclear Board specialists, the new method is stated to effect a 35 per cent saving on the current extraction process, using hydrofluoric acid.

A patent has been taken out by the board in principal countries of the world and it is expected that an agreement will

shortly be signed with the German company, Degussa for exploitation of the patent.

Details of the process are not available but it is reported that a feature of the new process is the use of fluoride and ammonia in place of hydrofluoric acid.

Structural Adhesive Withstands High Temperature

An inorganic adhesive stable at 800° F, with a room temperature shear strength of 285 lb./sq. in., has been obtained by H. H. Levine of Quantum Inc., Mt. Carmel, Connecticut, US, from the ammeline-phosphorus pentoride reaction product. Use of titanium dioxide as a primer and dimethylformamide as an extraction solvent enabled the above noted shear strength to be obtained from an original value of 65 lb./sq. in. Levine found evidence indicating that the adhesion was a result of chemical interaction between the adhesive and the stainless-steel surfaces. The report of this work is available from DSIR Lending Library Unit, reference PB 121908. 30pp.

Rumanian/Hungarian Pipeline Construction Ahead of Schedule

Construction of the 206-mile methane gas pipeline between Rumania and the Tiszapalkonya Chemical Works, in north-east Hungary, is expected to be completed by the autumn, about three months ahead of the original date fixed when work began on the pipeline last September. Cost of the pipeline, the largest yet built in Hungary, is estimated at more than £2 million. The chemical works, on which work began in 1955, will lay the basis for a large-scale plastics industry as well as producing about 280,000 tons of nitrogen fertiliser a year.

Magnesium Plant in Sardinia

It is reported that Magnesio SA., of Genoa, are to build a plant at S. Antioco, in Sardinia, for the production of magnesium. The new plant will use sea-water as raw material.

Japan's Chemical Exports

In the fiscal year 1957 (ended in March 1958) Japan exported, according to official statistics (values in $1,000), chemical and pharmaceutical products worth 136,439 as compared with 110,908 in the fiscal year 1956. The value of imports of chemicals and pharmaceuticals, on the other hand, was little changed at 176,572 (177,850).

Making Polyethylene Impermeable to Gases, Etc.

Addition of 0.03 to 3.5 per cent by weight of fluorine to the surface of polyethylene films and bottles is claimed to make them substantially impermeable to atmospheric gases, perfume components, aromatic flavour constituents, and preserving or pressurising gases. The properties of the polyethylene are stated to remain unchanged.

The fluorination process is claimed to be simple and economic. After washing the polyethylene free of lint, grease, dust and any other foreign matter which might cause fluorine to ignite this plastics material, film or container is brought into contact with pure fluorine or a fluorine-inert gas mixture at room temperature, or at up to 50° C. Length of time of contact varies depending upon the equipment, fluorine concentration, temperature and thickness of film or bottle.

Clarity, flexibility, tensile strength, heat sealability and ultra-violet transmittal are claimed to remain unchanged but permeability of the polyethylene is decreased. Tests have shown that with a volatile liquid, allyl caproate, 5.6 per cent was lost from an untreated polyethylene bottle in 40 days. After six hours fluorine treatment only 0.05 per cent was lost. Untreated film transmitted 303 c.c. per 100 sq. in. of surface in 24 hours. Treated film transmitted only 46 c.c.

Sulphur Production in Mexico

Production of sulphur in Mexico during March totalled 107,909 long tons as against 92,738 long tons in February, 113,567 in January and 104,777 in December 1957. Total 1958 production is expected to reach 1,233,158 long tons.

Three Frasch system extraction plants are in operation, plus the Pemex gas separation plant at Poza Rica, State of Vera Cruz, and a hand-mining plant at Los Cerritos, State of San Luis Potosi.

Protective Coating for Titanium

Protection of titanium from contamination during heat treatment by a water-soluble glass coating has been developed by Boeing Airplane Co., Seattle, US, as a means of reducing fabrication costs.

The coating is stated to be a soda-boron-aluminate glass with formaldehyde-resin binder and a suspension agent in an alcohol vehicle and is sprayed on to 6Al-4V alloy. After 15 minutes it dries to a glossy black. The titanium sheet is then subjected to heat treatment at 1,700°F. The coating peels off when the sheet is quenched. Only faint metal discoloration is caused.

Boeing are making sufficient coating for their own needs, but if use of titanium increases it is planned to license a manufacturer to fulfil orders for the coating.

Viscosity Modifier Cuts Epoxy Resin Costs

An organophosphorus compound developed by Monsanto Chemical is stated by the company to decrease effectively the viscosity of epoxy resins. As a result the resins can be poured easily into intricate shapes and are generally more workable. Compared with other additives available, the cost of the new additive, known as Mod-Epox, is claimed to be two to four times less.

Shell of Canada to Build New Unit

Fluor Corporation of Canada have been awarded the contract for construction of a distillate hydro-desulphuriser for Shell Oil of Canada.

Construction of the unit which will be set up at Shell's Shellburn refinery, North Burnaby, British Columbia, will begin immediately and is due to be completed next February. Total cost of this project, including the addition of necessary auxiliary equipment, is estimated at over $2 million (£740,000).

Indian Expansion Programme for Heavy Chemicals will be Largely Achieved

'THE original target of capacity for heavy chemicals (some miscellaneous chemicals and caustic soda excluded) will be substantially achieved but there will be appreciable shortfalls in the case of cement and dyestuffs and relatively smaller shortfalls under refractories.' This is stated in an appraisal and prospects of the second five-year plan 1956–61, published by the Government of India.

Details of the progress of the plan to date are given in the following tables:

INDUSTRIAL PROJECTS EXPECTED TO BE FULLY IMPLEMENTED BY THE END OF THE SECOND PLAN

Project	New or additional capacity
Nangal fertiliser project	70,000 tons of fixed nitrogen.
Mining part of the lignite project	3.5 million tons of lignite.
Streptomycin project under expansion of Hindustan Antibiotics	45,000 Kg. of Streptomycin.
Ferro-silicon expansion under Mysore Iron and Steel Works	15,000 tons of ferro-silicon.

Industry	Unit	Installed capacity: Original target	Installed capacity: Capacity (as at end of 1957)	Capacity likely in 1960–61	Further foreign exchange needed to achieve capacity under (5) (Rs. Crores)
Heavy chemical, fertiliser and allied industries					
Superphosphate (in terms of P_2O_5)	1,000s	120	50	80 (plus 3,700 tons of P_2O_5 in the form of ammonium phosphate)	0.4
Sulphuric acid	,,	500	252	420	0.3
Soda ash	,,	253	109	320	1.0
Caustic soda	,,	150	45	124	Neg.
Industrial explosives	,,	5	Nil	5	Neg.
Petroleum refining	Mill. tons crude	4.3	4.3	4.3	Neg.
Plastics, synthetic moulding powders	Tons	12,810	3,730	13,200	0.15
Cement	Mill. tons	16	6.63	9.3	1.8
Refractories	1,000s	1,000	498	820	0.5
Rubber manufacture (automobile no. of tyres)	1,000s	1,450	1,062	1,774	Neg.
Dyestuffs and intermediates—finished dyes	Mill. tons	27	11.7	12	Neg.

CHEMICAL ENGINEERING SYMPOSIUM—2

Systems of Project Organisation, by K. M. Curwen

DISCUSSING 'Systems of project organisation', K. M. Curwen (Albright and Wilson (Mfg.) Ltd., Oldbury, Birmingham),* said these were intended to enable process plant to be constructed and commissioned as quickly as possible at a minimum cost. However, 'project engineering' was used in differing senses according to the organisation concerned. To avoid confusion he defined 'project engineering' and 'process engineering'. This latter was the development of a chemical process from laboratory or pilot plant to a chemical engineering flow-sheet and included preparation of heat and material balances, brief plant specifications, general siting and approximate layout. Project engineering was the detailed design, both chemical and mechanical, drawing office work, construction and commissioning of plant. In this author's experience the division between process and project engineering was 'board authorisation' of the project itself. But in many countries the project engineer's responsibilities cover both process and project engineering as defined above.

Four Methods

Four common methods for a manufacturing company to work with a contracting firm in the project engineering field were considered by Mr. Curwen.

(a) The company carries out all process and project engineering with internal labour.

(b) The company carries out all process engineering, together with chemical and mechanical engineering, provides construction supervision, but employs a contractor for the actual construction of the plant.

(c) The company provides process engineering information and a contractor carries out all design and construction.

(d) The company buys a project in complete form based on the contractor's process information.

Other variations are, of course, possible. Mr. Curwen dealt particularly with projects handled by (a) and (b). While there were still quite a number of minor plants which could be installed using the labour force of the manufacturing company, the increasing complexity of modern processes made it necessary to employ a number of specialist engineers in addition.

Disadvantages of type 1 scheme spring largely from the lack of a project engineer. This system leads to considerable friction and delays in completion, according to Mr. Curwen. The chemical engineer is responsible for estimating the cost of the project and for obtaining authorisation but has no direct control over expenditure. This results therefore in over-expenditure.

With the type 2 scheme too many staff are directly responsible to the chief engineer, which is liable to result in difficult executive control. The engineer is also not fully responsible for all aspects. When construction starts, the project passes to another section and the construction engineer finds his responsibility divided between chief construction engineer and the chief chemical engineer. He is liable also to receive conflicting instructions. There is inevitably some loss of co-ordination at each stage.

In Mr. Curwen's opinion type 3 is a marked improvement on type 2. It represents a satisfactory system of project organisation for a manufacturing company spending at a rate approximate to £1 million per year on manufacturing sites scattered throughout Great Britain.

Projects come from three general sources:

(a) the company's research department, generally with results of pilot-plant experience.

(b) from the production department when additional capacity is required for existing processes.

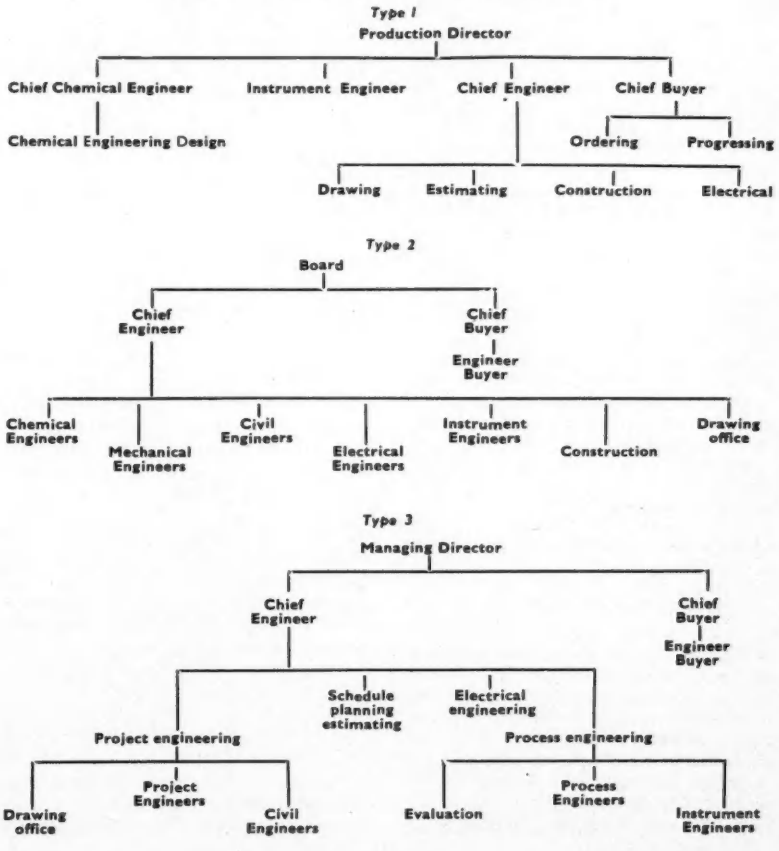
(c) from another company when plant is to be installed and operated under licence or similar agreement.

Warning was given by Mr. Curwen regarding pressure on the engineering department to complete a project in the shortest possible time, with the temptation to start detailed project engineering before process information is available. In passing a partly completed process report to the project section the total output of an engineering department is decreased. He stressed that the process design report should always be completed before detail design commences. However, it was desirable sometimes to order some long-delivery equipment at an earlier stage.

Of design models, Mr. Curwen favoured two being produced during the course of the project. The first, approximately $\frac{1}{4}$ in. = 1 ft. (1:48), is constructed during the later stages of process engineering as an aid to general layout and to provide discussions with project engineers and representatives of production departments. The second model, scale $\frac{1}{2}$ in. = 1 ft. (1:24) includes all piping and is used for detail design, erection and training.

Mr. Curwen reported that a sub-contractor will generally submit a low price on the basis of a scale model as he has a clear understanding of the project and therefore can decrease his contingency allowance. The model, together with

SCHEMES OF COMPANY ORGANISATION



★ *The symposium on 'The Organisation of Chemical Engineering Projects' was held from 24-26 June by the Institution of Chemical Engineers and the Institute of Petroleum. For report of opening papers see Chemical Age, 28 June, p.1203*

isometric pipe-sketches is adequate for plant construction and a saving in piping design time and cost results. The scale model also proves very valuable for training process operatives.

Production of such models costs about 1 per cent of the overall project cost, but it saves time and results in better layout and piping economies. The final cost is less than when the normal orthographic methods of design are used.

At the start of project work, a time-schedule should be prepared indicating the period during which a given phase of the report will be handled. When design work has reached finality, a final schedule is prepared giving in detail the time of call-in of plant and other equipment and a schedule of construction-labour on a week-to-week basis. It should be possible by then to schedule deliveries of raw materials for use during commissioning and the running-in period.

For mechanical design, Mr. Curwen recommended for greater economy, the employment of the largest reasonable number of draughtsmen, to complete the work in the shortest time. For a project costing £100,000, approximately three draughtsmen and a section leader can be economically employed. On a small complex process unit it might be better to employ four or five draughtsmen for a £100,000 project, whereas a large continuous process unit operating on a familiar process would need less draughtsmen.

Material lists should be produced as soon as possible and should include some form of number reference system for plant-piping, fitting, etc., with these numbers common to drawings, models and full-scale plant.

For financial control, the project engineer should have available up-to-date returns from the cost department. A contingency allowance is necessary. This should only cover uncertainties in site and erection conditions. It should not include any sum for possible increases in prices during the construction period which are best allowed for by the company's budgetary-control system, neither should minor modifications in designs be included, these being dealt with in the allowance on the total of plant item.

Finally Mr. Curwen pointed out that no system could work satisfactorily unless the correct information was fed-in initially. The most important point of any system of project organisation was that it must give the project engineer adequate responsibility.

THE ANALYSIS AND FUTURE USE OF PROJECT RECORDS

PROJECT records and analysis of these were considered by two speakers at the symposium. The first speaker was T. S. Card of The Distillers' Co. Ltd., who examined project records kept by this company's engineering division, and the second was R. Adams of George Wimpey and Co. Ltd., who dealt with the analysis of job-records from the constructor's angle.

Distillers' engineering division has its own design staff and specialist technical sections; it carries out procurement, inspection and progressing of plant and equipment and it supervises construction work for which outside contractors are normally employed.

The records kept for such a project are classified as follows: engineering and design; procurement, inspection and expediting; financial and estimating; administration; operation.

The main purpose of project records, said Mr. Card, was to ensure that a job was completed to technical satisfaction to time, and within the sum allocated. He pointed out that the records had a use in design since new designs were nearly always based on existing designs to a greater or lesser extent. Plot-plans and plant layouts were very much the product of experience, and a study of past jobs was most helpful. It has been found, for instance, that draughting hours spent on pipework amount to about 60 per cent of the whole and since draughting was expensive it was worth while to attempt to reduce this by the use of models.

Information about suppliers was required. And this was best obtained from past recorded experience. Competitive tendering was the rule. From the Distillers' engineering division, the contract records covered all types of organisation of contract but the overall conclusion was that there was no 'best' type of contract for all circumstances.

Regarding 'cost-plus', experience, said Mr. Card, had taught that possibly the worst feature of 'cost-plus' was that the contractor could be started on work, spending money, before the client had fully finalised his specification of the job in detailed form, so causing delays and alterations and consequent over-expenditure.

Lump-sum Contract

On the other hand there was the lump-sum contract. The snag in this type of contract was that of modifications and alterations in scope which the client was so frequently compelled to introduce at extra cost. An extensive inspection team was also necessary to ensure that work was done according to specification. An in-between type of contract seemed to work best in many cases.

Recorded experience dictated that every attempt had to be made to avoid the necessity of contractors' claims for extras. Records were also useful in cases where the purchase of foreign plant was contemplated since the amount of import duty payable, and whether remission of duty could be obtained, could be judged.

In this post-war period the escalation curve was an essential tool in the estimator's equipment. The escalation curve for a complete plant was built up from a number of sources, each being given its due weight. By taking factors such as official cost indices, equipment-suppliers and contractors' increases in cost, increases in labour charges and costs of materials into account, a company produced its own curves applicable to its class of work. Analysis of the records of the final cost of plants was used to indicate what 'contingency' should be included in an estimate.

Sir Leonard Owen's Paper Discussed

IN discussion on Sir Leonard Owen's paper (see last week's issue, p. 1203) Mr. J. O. Dugdale-Bradley, Institute of Petroleum, said that he had not appreciated to what extent chemical plant was a part of the UK AEA's work. UK AEA projects differed, he said, from commercial projects. In the commercial world, time and price were of greater importance.

He considered that five years from the research stage to the final project stage was a long time.

Mr. Dugdale-Bradley also remarked on the fact that the UK AEA seemed to enclose its plants completely. The tendency today was to leave them open. He also enquired whether models were used by the UK AEA as they were by commercial firms.

'Ample Time'

Sir Leonard said he was surprised that five years was thought ample time from research to final project stage. He thought it was less than the normal time. The separation of construction and maintenance was quite normal for the AEA.

Research was controlled by the project leader. At the start of a project an agreed research programme was worked out. For example, at Dounreay it was agreed that niobium should be eventually fabricated into tubes. When work was begun this was something which had never been done.

Regarding enclosure of buildings, he said that they now tended to put them more in the open. They did use models, he said, but more from the architectural point of view, 'to show our betters what we are doing'.

A speaker remarked that the term project engineer meant different things to different people. To this Mr. Turner said that it was desirable to have a uniform meaning for the term.

Mr. G. F. Dutton, Petrochemicals Ltd., mentioned the widespread responsibility of the project engineer. Sir Leonard made the point that someone must make the final decision.

Mr. E. W. Rodnight, British Oxygen Co. Ltd., was at a loss to understand how one man could be responsible both for mechanical and chemical engineering when he had only one chemical engineering assistant.

Sir Leonard said that a lot of the flow-sheeting was done by the research and development staff.

PLANT COMMISSIONING FOR AN OIL REFINERY

EVENTS and experiences in commissioning a large new 'grass-roots' oil refinery were described by D. W. K. Barker, British Petroleum Co. Ltd., Britannic House, London. (Mr. Barker's paper was presented by Mr. C. V. Rollinson of the same company.) He reminded symposium members that while it might be thought that commissioning amounted to little more than intense activity display during the short period of time between completion of construction and the start of commercial operations, 'Commissioning truly begins with basic design, . . . nor, in its widest sense, does commissioning cease until the full capabilities of a plant have been systematically and exhaustively assessed.'

The first step, stated Mr. Barker, was to set up, at the very beginning, a composite, detailed target programme, embracing both construction and commissioning, based on a realistic appreciation of all the various factors involved. Generally, there was ample time (as much as six or nine months) to secure the engineers' and operators' approval of the design and function of the plant and marketers' approval of the anticipated pattern of product quality and yield before the first material order was placed and site work started. 'Once an approved technical dossier has been compiled, every effort should be devoted to meeting the completion programme, and none squandered on devising ways and means of doing things differently.'

The refinery described by Mr. Barker was contracted for in November 1952 and called for completion of construction in 30 months. In fact, all utilities had been commissioned by January 1955 and the first process plant, a crude distillation unit, came on stream in February and the whole project was in commercial production by mid-April. The refinery in question is that at Kwinana, 15 miles south of Fremantle, Western Australia. Starting point for setting-up the commissioning programme was a block-operating diagram of the refinery when in full running order.

It was determined that the order in which the units were to start up were:—Crude distillation unit A, platformer, hydrofiner, vacuum distillation unit, catalytic cracker and crude distillation unit B. The decision to set in motion the machinery of commissioning was of the utmost importance and had to be based on a realistic assessment of the status of construction several months ahead of completion and invariably involved some degree of guess-work and risk.

Not much had been said of what was perhaps the most important single factor in all factory operations, and on which efficiency and economy depended—namely, staff.

In this case, that of the Kwinana refinery, job-evaluation techniques were utilised to determine the work-load for each individual post, with the objective of arriving at minimum numbers of operatives, establishing the bases for training courses, and providing the recruiting group with specifications (age, educational background, skill and experience). To compensate in advance for the inevitable 'Parkinson's Law' effect of creeping growth, the calculated optimum operational strength was reduced by 10 per cent and commissioning was accomplished by bringing in teams of operators and technicians. A system of 'sequential training' was devised and applied, whereby, under the guidance and supervision of professional instructors, members of the technical staff gave instruction to their subordinates.

During recruitment and training minutely detailed commissioning manuals were prepared in orderly sequence, machine by machine, operation by operation. These were continued with job-evaluation cards to produce step-by-step procedures for each successive phase of commissioning, and broken down into individual instructions for each operator, engineer and artisan. At the same time, the shape and content of the multiplicity of forms, records, tags, product movement and stock statements, requisitions, work orders, etc., and the complete accounting system were finalised, printed and brought into use as occasion demanded. Safety regulations, codes of practice for engineers, electricians, and boiler attendants, foremen's handbooks, and other information and instruction pamphlets were issued.

In pre-commissioning, the individual in charge of commissioning (and responsibility should be lodged with one person to co-ordinate activities) deploys his various forces, plant inspectors, development chemists, engineers, instrument men, safety men and operators, satisfies himself that the unit has been built in accordance with the drawings, that all proving tests have been properly executed, all machines checked over and run in, that all potential hazards have been assessed and allowed for, that relief and blow-down systems are all clear, etc.

Mr. Barker said that the most frequent source of difficulties in commissioning was failure of mechanical equipment, pumps, motors, turbines, switchgear, instruments, etc.

The actual operation of bringing a unit or utility on stream was probably best conducted by striking a nice balance between caution and boldness, exercising judgment when to hold back and when to press on. A test-run should be deferred after at least three to four weeks' continuous operation. It was a common mistake to send the supernumerary technicians away too soon. It was probable, suggested Mr. Barker, that the greatest sustained effort had to come from the instrument mechanics.

The present-day need to keep down investment and operating costs had led to an increasing extension of plant integration. Where integration was a sought-after objective, during the design-stage it was prudent to bear in mind the peculiar exigencies of the commissioning period and provide inter-unit holding facilities. In fact, the guiding principles for successful plant commissioning were that nothing must be left to chance.

Commissioning a Coke-Oven Plant, by A. F. Cottrell

THE paper by A. F. Cottrell (Woodall-Duckham Construction Co., London SW3) on 'Plant commissioning' described the procedure for putting into commission a coke-oven plant and the care and precautions which were necessary at each stage.

Commissioning activities usually fall into three main phases:

(a) A small force of operating engineers is placed on contract several months before production is due. This team makes preliminary inspections and tests, checks completeness of equipment, surveys local conditions, breaks down and simplifies flow-circuits and systems by means of diagrams and detailed references.

(b) The main operating force should arrive some weeks later and starting-up procedure begins according to a predetermined programme and utilising the advance team's information.

(c) When production has been attained and stabilised, the operating force is gradually reduced until the purchaser takes over control.

Processes on the by-product side called for units of robust construction, tightness and simplicity so that day-to-day maintenance and supervision were not excessive, that process-labour requirements were as low as possible, and that the overall life was long.

In initial testing at by-product plant, tightness of every vessel and joint was of paramount importance when dealing with toxic liquids and inflammable gases. Careful testing during plant erection was required particularly, as with other construction proceeding on a large site, there would be a multiplicity of compressed air, oxygen and gas lines.

Although all vessels were tested in the presence of the contractor's inspectors for tightness in the fabricators' shops, it was still necessary to re-test every single item after erection to guard against the effects of any damage during transit or in site handling.

A more comprehensive examination was necessary when erection was completed

with valves and cocks in position and subsidiary pipe lines and services connected. For this purpose the whole plant should be sectionalised between valves, and every joint and connection tested by means of a soft-soap solution to pin-point the slightest leaks.

The commissioning engineers then: (a) put all cooling water circuits into operation for trial-runs, taking emergency measures, etc.; (b) run exhausters on air, check motion of governors, action of speed-trips, etc. (usually with the makers); (c) run all detarring units; (d) operate all pump-circuits and make up false circuits to apply tests to key units; (e) carefully re-examine and certify findings with regard to all vessels, coolers, stills, storage tanks, etc.

In this way the operatives acquire considerable knowledge of their duties and when the time for commissioning arrives, they have a fair understanding of their specific sections. Trouble taken in preliminary trials with frequent repetition was well worth while, said Mr. Cottrell. Experience had shown that machines or components could pass through a series of tests prior to those carried out on the site and still fail when normal duties were started.

Concluding his remarks Mr. Cottrell said that each new installation had to be given careful study long before it began to work and had to be put in the hands of commissioning engineers who not only had considerable technical ability and knowledge of the processes involved (in the case of coking plants, of coking and ancillary processes), but were also keen enough to work all the hours necessary to ensure that the pre-arranged programme was meticulously followed.

WIMPEY PAPER ON ANALYSIS OF PROJECT RECORDS

SOME salient feature of large construction projects were dealt with by R. Adams (George Wimpey and Co. Ltd., London W6) in the second paper on the 'Analysis and future use of project records'.

Analysis of previous records of performance assisted in showing trends and in this were a directly useful asset. Records should be used in the early broad study of each new project to aid the necessary analytical approach to planning each job anew. Detailed examination allowed adaptation of previous data to be applied in a manner essential to the successful conclusions of modern, complex refinery and chemical work.

Costing and account system began at the flow-sheet and in the preliminary engineering required to make estimated forecasts of costs.

An account code was indicated for the following:

A Refractory brick-work	M Machinery
B Conveyors	N Tubular exchangers
C Piping	O Painting
D Structures	P Pumps and compressors
E Electrical	R Columns and vessels, etc.
F Fire-proofing	W Modifications in direct consumption accounts
G Tanks	X Miscellaneous site and office services, salaries, etc.
H Furnace and stacks	
J Insulation	
K Instruments	
L Ventilation	

/1 Scaffolding
/2 Temporary services
/3 Site and office services, etc.

Several methods of assessing the number of man-hours for design and for construction were in use—for design it might be a percentage of the estimated costs; for construction, it might be man-hours per ton of permanent materials, etc.

Installation man-hours per ton of pipework could range from about 45 man-hours/ton for 24 in. pipe to 960 man-hours/ton for 2 in. pipe. The cost of design and engineering of a complex project might be say 10 per cent of total cost whilst for a simpler job, such as a cooling-tower, pumps and piping, it might be only 3 per cent. Man-hour records provided the cost and the period allowed for design was known. Total man-hours could then be calculated as a percentage of the total capital-cost estimate and hence the total number of men required could be obtained.

Schedule records of expected deliveries of major equipment helped to determine the order of priority of design-work, to enable the purchasing department to ensure delivery in the time required by the targets shown on the project schedule. Delivery date records needed to be brought up-to-date periodically.

Estimating provided an example of the use of analysed project records after the performance of previous similar jobs or similar sections of previous jobs. From previous records, the capital cost per item was marked on the data sheets, together with packing and shipping costs. Labour and installation costs were co-related with the data sheets so full cost and technical details of all major items of equipment were available for the current job and for future use. In estimating it was safer to use current quotations for final accuracy, if time permitted.

With charted analysed records, an estimator could build up an approximate estimate in a fraction of the time required to design and issue for quotations, thereby making a large saving in estimating time and design man-hours. The curves can be brought up-to-date by factors arrived at for multiplying the basic costs to adjust them to current prices.

For a large and complex job, technical and construction costs tend to reduce in relation to the materials cost. The cost of technical services varied between about 15 per cent for a £1-million job to 6 per cent for a £20-million refinery.

From past records and recent checks by the purchasing department delivery-periods were known for a range of sizes and types of pipes, etc. Preliminary bulk-orders were therefore placed at the earliest time for piping, main tankage, steel valves and certain other equipment and details adjusted with the supplier when the design was sufficiently advanced to state specific requirements.

Previous expediting-records could be examined to show which companies, and to what extent, they were likely to over-run the promised delivery date.

Charts were valuable in field construction organisation with regard to economy of staff and artisans, equipment and tradesmen. Record-cards of all men should be kept and should be periodically reviewed to control excessive or unauthorised absenteeism. Time-records collated with work units indicated the number of productive man-hours on each operation together with its cash value. Labour costs could be sub-divided into direct construction and overheads ancillary to construction. The former is cost against each process unit and the latter against smaller categories, e.g. staff-salaries, office-equipment, etc.

A tool of management whichwas becoming increasingly used even on construction work where repetition of operations was not as high as in other industries, was work study. The increasing application of mechanical gear also tended to call for work study. Capital investment on automation equipment had, of course, to be taken into economic account.

In Parliament

KID and the Price of NHS Drugs

In reply to a question regarding the possible amendment (under the terms of the Safeguarding of Industry Act 1921 and amending legislation) of the key industry duty payable on steroid hormones and certain antibiotics and vitamins, the President of the Board of Trade reminded the House that the duty would lapse at the end of this year and would be embodied in the new tariff schedule. Prices charged to the National Health Service for such drugs were a matter for the Minister of Health, but Sir David Eccles said that if he received any application by users for a change in the duty he would consider whether any action was called for.

Shell Pipeline Bill Opposed by Corporation

Liverpool Corporation are petitioning against the Shell (Stanlow to Partington Pipeline) Bill, it was announced recently. A petition praying to be heard against the Bill has been deposited in the Private Bill Office of the House of Lords. The Bill, which received a second reading on 26 June, is due to come before a select committee of the Lords on 15 July. Shell Petroleum Co. Ltd., are seeking powers to construct pipelines between the Stanlow Oil Refinery and the Partington Chemical Works, to acquire lands, and for other purposes.

First Plant For Hydro-refining of Benzole

The first plant in the UK for the hydro-refining of benzole has been ordered by Lancashire Tar Distillers Ltd. for their Cadishead Works. This plant has been designed by Lurgi to use the BASF/Scholven process and will be built by Simon-Carves Ltd., Stockport.

MASS TRANSFER IN THIN LIQUID FILMS STUDIED

Rate of Absorption is Independent of Gas Velocity Say Soviet Workers

THE absorption of gases of small solubility in tubes and ducts with wetted walls has been examined for comparatively low gas speeds (0.1 to 6 metres/sec.) by several investigators (1–5). Their general conclusion is that the rate of absorption is governed by the resistance to mass transfer of the fluid phase and is thus independent of the gas velocity. The absorption of highly soluble gases (ammonia–water) at high gas velocities (up to 40 metres/sec.) has also been investigated. Recently an account has been given (6) of further Russian work on the absorption of carbon dioxide in water with high gas velocities, with particular reference to the hydrodynamics of the liquid surface, and a short account of the investigation is given below.

Experimental work was carried out in tubes of diameter 10.5 mm. and 16.6 mm., with gas velocities between 11.6 and 39 metres/sec. The gas flow was vertically downwards, while the liquid could flow upwards or downwards along the wall of the tube, thus giving counterflow or uniflow conditions, respectively. The Reynolds number Re of the liquid phase was in the range 5 to 105 for counterflow and between 15 and 200 for uniflow conditions.

Figs. 1 and 2 show the relation between the absorption coefficient and the Reynolds number for different gas velocities for uniflow (Fig. 1) and counterflow (Fig. 2) conditions. In Fig. 1 the dotted line shows, for the purposes of comparison, the experimental data for the absorption of CO_2 in water. The results show that the gas velocity in uniflow conditions has a greater influence upon the absorption rate than in counterflow; in this second case, the experimental points for gas velocities 11.5 to 39.0 metres/sec. lie in a narrow band between the limits shown.

Rate of absorption of gases of small solubility is governed, to a great extent, by the wave formation on the surface of the thin liquid film, the main dimensions of which are the wave length λ and amplitude a. Little attention has previously been paid to this factor, and experiments were therefore carried out to compare the calculated forms with those actually observed and to relate the absorption characteristics to those of the wave formation.

The wavelength was measured either by direct photography or by using an oscilloscope; in this second case, two platinum electrodes were inserted flush with the wall of the tube in the same horizontal plane and distance 2 mm. apart. The flowing liquid completes an electric circuit between these electrodes and the resistance of the circuit varies with the thickness of the fluid layer, so that the oscilloscope record may be used to determine the wavelength. This may also be calculated from the hydrodynamic equations for wave formation in two-phase flow (7, 8), but assumptions must be made concerning the form of the velocity profile within the flowing liquid; calculations have been made for both linear and parabolic profiles under both counterflow and uniflow conditions.

Fairly good agreement was obtained between measured and calculated wavelengths, and any lack of agreement is probably connected with the choice of velocity profile previously mentioned and also the ratio:

$$z = \frac{\text{Phase speed of wave}}{\text{Mean velocity of the fluid}}$$

By the usual methods of measurement this has been found equal to 2 for uniflow and approximately 2.4 for counterflow. Furthermore, theoretical considerations show that the limit for the ratio:

$$\frac{\text{Wavelength } \lambda}{\text{Mean thickness of layer } \delta_0} \geqslant 13.8$$

but measurements agree fairly closely down

$$\text{to } \frac{\lambda}{\delta_0} = 8.0$$

To determine the amplitude of the wave profile, the change of electrical resistance of the fluid film, depending upon the form of the surface, is used. On the supposition that the wave profile is sinusoidal we have:

$$\alpha = \sqrt{(\rho_B^2 - \rho_L^2)} / \rho_B$$

where ρ_B = specific resistance of the wave.
ρ_L specific resistance of the undisturbed layer.

Measurements were made using two ring electrodes and a microammeter to measure the change of current in a circuit. Fig. 3 shows the results of measurements for wave amplitudes with different gas speeds in counter and uniflow conditions; the value of α changes from 0.86 to 0.48 for rising flow and increased velocity, but appears to be independent of gas velocity for counter flow.

Fig 4A gives the experimental results for measurements of the coefficient of absorbtion of CO_2 in water with different lengths and amplitudes of wave for counter flow and uniflow conditions. An examination of the evidence shows that the data on mass transfer may be represented by a single curve, provided that the mass transfer coefficient is proportional to the square of the amplitude. Plotting as ordinate $K = K_{fluid} \frac{0.46^2}{\alpha^2}$ (where 0.46 is the measure of amplitude for counterflow) the experimental data lies on a single curve, given by the equation

$$K = K_{fluid} \frac{0.46^2}{\alpha^2} = \frac{3.39\ 10^{-4} \text{ metres}}{\lambda 1.21 \text{ hour}}$$

$$K_{fluid} = 1.52\ 10^{-3} \frac{\alpha}{\lambda 1.21}$$

as shown in Fig. 4B.

(*continued at end of next page*)

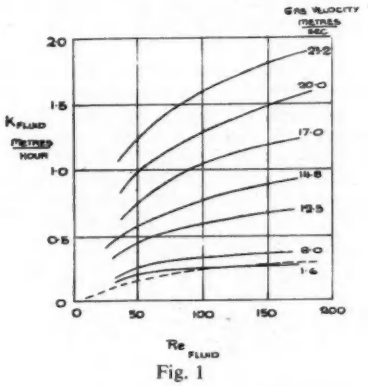


Fig. 1

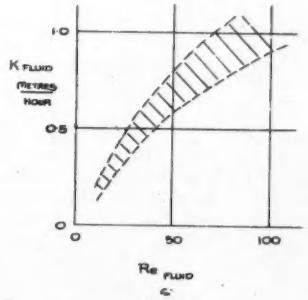


Fig. 2

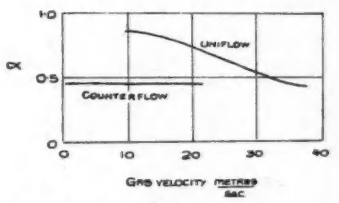


Fig. 3

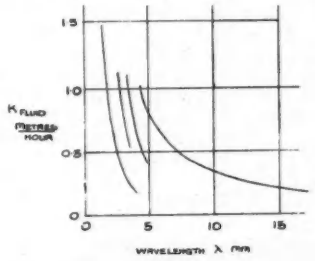


Fig. 4a

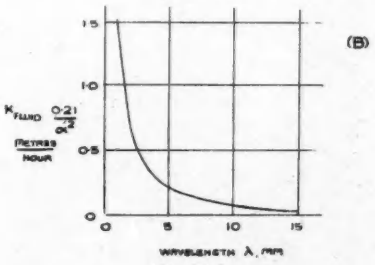
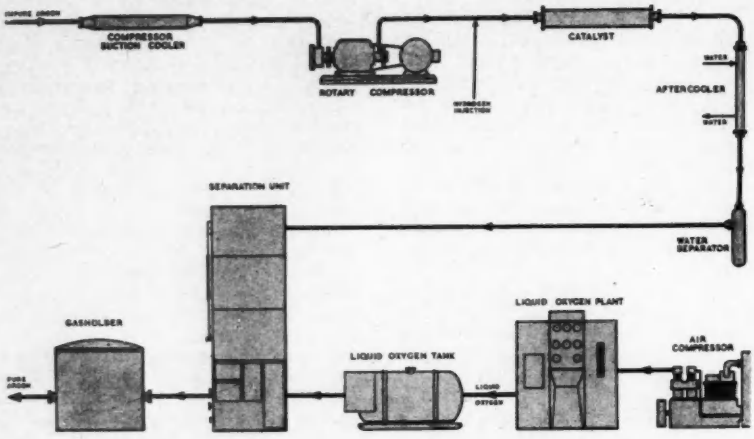


Fig. 4b

NEW BOC ARGON PURIFICATION UNIT UNDER WAY AT DOUNREAY



SIMPLIFIED FLOWSHEET OF ARGON PURIFICATION PLANT

A LOW temperature distillation plant for argon purification devised by British Oxygen Co. Ltd., now being built at Dounreay will be the largest of this type operated by UK Atomic Energy Authority.

Impure argon, at sub-atmospheric pressure and containing up to 0.2 per cent by volume of air leaves the UK AEA process and after admixture with electrolytic hydrogen is compressed to about 25 p.s.i.g. in a non-lubricated rotary compressor. The argon is passed over a palladium catalyst where the oxygen impurity is converted to water. By means of a recycle circuit the hydrogen injection can be controlled to the stoichiometric requirements.

The oxygen-free argon is dried by refrigeration in duplicate heat exchangers, cooled, liquefied and separated by distillation into pure argon and a nitrogen-rich fraction which is rejected. Excess hydrogen is separated and is returned to the compressor suction. Purified argon passes back through the heat exchangers to the dry seal gasholder and thence to the UK AEA process. The distillation column and heat exchangers are contained in a compact thermally insulated unit.

Refrigeration is provided by the evaporation of liquid oxygen which is supplied from a standard BOC liquid oxygen plant. To minimise liquid oxygen losses, the transfer line to the argon purification unit is thermally insulated by a vacuum jacket.

The installation purifies 3,300 ft.^{3}/hr. of argon and reduces the oxygen content to less than 10 v.p.m. and the nitrogen to less than 40 v.p.m. It will operate for at least 1,000 hours continuously.

Discussion on NCB Coke Plant Effluent

JARROW-ON-TYNE Corporation has had an interview with the National Coal Board regarding the effluent from the Monkton Coke Works and the NCB has promised to investigate the matter. At a meeting of representatives of the corporation and the board it was admitted that the effluent from the works was not treated before being discharged into the sewers, but it was stated that when effluent was discharged through sewers into tidal waters, any poisonous effects were almost completely eliminated.

A plant to deal with the effluent would cost about £50,000 plus £40 a day for maintenance. The NCB undertook that a plant would be built at Monkton after a report and analysis had been received from the board's scientific officials.

Iranian Students Visit CJB at Olympia

These Iranian students are seen on the Constructors John Brown stand at the Chemical and Petroleum Engineering Exhibition with Dr. Mark Guter, CJB's chief chemical engineer (see also p.17)

Price's Study Water Storing in E. Africa

PRICE'S (BROMBOROUGH) LTD. are co-operating with the East African Meteorological Department in extended trials at reservoirs at Nachingwea in Tanganyika on the use of a monomolecular film of fatty alcohols to conserve stored water. On 1 July Mr. C. E. Higgs, of the company's technical service department, who spent three years in East Africa during the war, left for Kenya to assist in these trials. He will spend 12 weeks in British East Africa and will visit the Sudan on his return journey.

The practical use of a fatty alcohols film for preventing evaporation of water in hot and arid climates was pioneered by the CSIRO of Australia in association with Price's. As a result a blend ('Si-Ro-Seal' hexadecanol) was developed for Australian climatic conditions. Further research is being done by Price's in East Africa so that the blends and techniques best suited to that area may be discovered.

C. E. Higgs of the technical service department conducting field trials

Price's (Bromborough) Ltd., Bromborough Pool, New Ferry, nr. Birkenhead, have recently appointed Gailey and Roberts Ltd. as their selling agents for water conservation alcohols in Kenya, Tanganyika, Uganda and Zanzibar, and ICI (Sudan) Ltd. for the Sudan.

MASS TRANSFER

(*Continued from previous page*)

The above summary indicates the importance of hydrodynamic considerations of wavelength and amplitude on mass transfer, factors which do not previously appear to have received much consideration. The concentration between the theory and experimental evidence is by no means complete and indicates a need for further work on this topic, in view of its fundamental importance in many aspects of chemical engineering.

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CIBA'S GROUP TURNOVER ROSE 7·8% LAST YEAR

REFERENCE was made by Dr. R. Käppeli, chairman of Ciba Ltd., Basle, in his report for 1957, to the company's adherence to the principle of financing extensive development projects, particularly abroad, out of their own resources, even when circumstances would permit approach to the money market. To a certain degree the question was justified, said Dr. Käppeli, but it did not take into account the fact that the company's factories abroad were not entirely independent units but part of a whole. The consequence was that the outsiders could only be induced to risk their capital to a limited extent.

In spite of difficulties, such as trade restrictions and Middle and Far East political events, the Ciba organisation achieved total sales to the sum of S frs. 891 million (£74.2 million) which is 7.8 per cent above the 1956 figure.

Ciba's world turnover in dyestuffs was appreciably higher than in the previous year, owing to increased demand and relatively stable prices. Little sign of recession was noted in Western Europe's textile industry, unlike US production which had been restricted.

The increased turnover in 1957 in Ciba's pharmaceutical products was mainly based on increased sales of the European and Latin American concerns 'in spite of very keen competition.' Demand had also expanded in Asia, principally from India, Japan and the Middle East. Little change was noted in Africa and Australia.

Plastics Sales Up

Expansion of Ciba's plastics sales was based mainly on increased demand for Araldite resins. Sales of urea and melamine adhesives have also shown a marked increase. Textile application products such as softening agents, optical whiteners, and permanent water-repellent finishes were also in greater demand.

Last year, tropical medicinals figured prominently in the list of research projects of Ciba's pharmaceutical section. In the plastics sector, Araldite resins were further dedveloped, and in the melamine resin field, the new coating resin Cibadur was introduced. Research costs rose and total expenditure during the year under review, increased to S frs. 52.5 million (£4.4 million) two-thirds of which was devoted to pharmaceutical research.

Of the associated companies in Great Britain, Clayton Aniline Co. Ltd. had increased their sales considerably. The additional profit would be used in financing the new capital expenditure programme on which it had been decided to spend a considerable sum over the next 10 years to modernise plant and building.

Expenditure by Ciba Laboratories Ltd. (the British pharmaceutical company) directly on research and in support of research, totalled more than 12 per cent of turnover. The chemical raw material plant at Pyewipe, Grimsby, maintained a very rapid growth in the volume of production, and additional plans are on hand for further expansion of capacity.

Aero Research Ltd., the plastics company, continued their steady progress, with increased turnover and profits. New laboratories, where long-term research will be conducted, are being built, and a team of chemists will start work in them in the autumn. Construction of the new Araldite plant is nearing completion.

In Europe, increased sales are reported from Ciba's dyestuffs factory at St. Fons, France, and pharmaceutical sales were maintained by Laboratoires Ciba, Paris. Due to easier import policies, Ciba Industria Chimica, Milan, was able to increase sales of dyes and pharmaceutical products but the market in plastics showed a decline. The German and Spanish associate companies both increased their sales.

Ciba States Ltd., in North America, report a very satisfactory year for the Ciba interests in the US. Ciba Co. Ltd., Montreal, had an active year. In South America, Productos Químicos Ciba SA, Buenos Aires, had a greater total turnover, sales of dyestuffs and pharmaceuticals increasing. The Indian companies Ciba Dyes (Pte) Ltd, Bombay, and Ciba Pharma (Pte.) Ltd., Bombay, both recorded a higher volume of sales and additional manufacturing plant was put into operation by Ciba Pharma.

Ciba Co. Pty., Melbourne, expanded their sales of dyestuffs and Ciba Products Ltd., Osaka, Japan, increased their turnover of pharmaceutical products manufactured either by Ciba companies or in co-operation with Japanese concerns.

Net profit for the year rose by S frs. 1,042,377 (£86,860) to a new level of S frs. 23,503,349 (£1,975,312). Out of this, S frs. 6,950,000 is allocated to welfare and research funds.

Current Expansion Projects of African Explosives and Chemicals

FIXED assets of African Explosives and Chemical Industries Ltd., have increased by over £11 million, and represent capital expenditure on various extension projects and the surplus of revised values of manufacturing assets. Mr. H. F. Oppenheimer, chairman, states in his annual report, that as a temporary means of financing further capital expenditure arrangements have been made with the two shareholders, De Beers Industrial Corporation Ltd., and Imperial Chemical Industries (South Africa) Ltd., to borrow on loan account. At 31 December last, these loans amounted to £3 million.

Manufacturing and trading profits for the year to 31 December, 1957, amounted to £4,005,198, an increase of £264,089 compared with the previous year. An interim dividend of 4 per cent and a final dividend of 6 per cent, make a 10 per cent total for the year.

Plant extensions at the Umbogintwini and Somerset West factories which will increase fertiliser production capacity to not less than 800,000 tons annually, are now at an advanced stage.

Production has started at the new granulating section of the new superphosphate plant of the subsidiary company, African Explosives and Chemical Industries (Rhodesia) Ltd., at Rhodia. Operations are expected to be fully established in all sections shortly.

Industrial chemicals sales increased in volume during 1957. The new chlorine, solvents and plastics plant at Umbogintwini is now functioning at full rate capacity to meet demand for these products.

A start has been made on a large extension of the nitrogen manufacturing capacity at Modderfontein, involving estimated capital expenditure of £10 million. The project includes: extension of ammonia capacity by 70,000 tons a year, bringing total production to 145,000 tons per annum; and, installation of plant to convert the additional output into about 110,000 tons of urea (with other local sources of nitrogen this is expected to satisfy the estimated annual requirements of nitrogen for agriculture in Southern Africa for some time). Operation of the existing No. 2 ammonia plant, of 50,000 tons/year capacity, is to be converted from metallurgical coke usage to low-grade coal. Production at both new and extended plants should start in 1960.

Modernisation and extension of Vynide division is well advanced. Plant now installed is operating at full capacity. The whole project is expected to be completed early in 1959.

Efforts are being made at the Klipspruit cyanide factory to overcome certain technical difficulties experienced in operation of the new extensions which include coal gasification and methane synthesis. Rand Carbide are maintaining their position in local trade, based to an increasing extent on carbide for chemical manufacturers, including production of p.v.c. and chlorinated solvents at Umbogintwini.

ICI Dumfries Plant To Make Methyl Cellulose

Methyl cellulose is to be made by the Nobel Division of Imperial Chemical Industries Ltd. A plant to produce a wide range of methyl cellulose grades is in the course of construction at Dumfries where, already, the division has several chemical installations. It is stated that the capacity of the ICI plant and the range of its products will be sufficient to satisfy the existing and anticipated UK demand for all grades of methyl cellulose. At present certain grades are imported from the Continent.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s 3d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

AMENDED SPECIFICATIONS

Copies will be on sale 16 July or as soon as possible thereafter.

Ammonium nitrate for reducing or preventing its tendency to cake. Nitroglycerin Aktiebolaget. **742 636**

ACCEPTANCES

Stabilised vitamin-D composition. Hoffmann-la Roche & Co. AG., F. **799 068**

Manufacture of slags rich in alumina from metallurgical smelting processes. Hüttenwerk Rheinhausen AG. **799 117**

Fluorinated polyesters. Dow Corning Corp. **798 824**

2-Ethyl-2-sec-butyl-1, 3-propanediol dicarbamate. Carter Products, Inc. **798 848**

Fluid sampling apparatus. Gould, J. P. **799 085**

Composition for reversal of inflammation in animals. American Cyanamid Co. **799 069**

4 - Tert. - butyl - alpha - methyl - hydro - cinnamic aldehyde. Givaudan & Cie Soc. Anon., L. **798 901**

Open to public inspection on 23 July

Separation of plutonium. Thompson, S. G., and Seaborg, G. T. **798 685**

Production of uranium. Spedding, F. H., Wilhelm, H. A., and Keller, W. H. **798 518**

Process for the production of combustible gas enriched with methane. Gas Council. **798 741**

Production of alloys of aluminium with plutonium, uranium or thorium. UK Atomic Energy Authority. **798 687**

Redistributing fluorine throughout a catalyst mass. British Petroleum Co. Ltd., Porter, W. F. B., Turner, R., and Housam, E. C. **798 435**

Modification and production of titanium ester compounds. Du Pont de Nemours & Co., E. I. **798 412**

Process for separating normal paraffins from mixtures of hydrocarbons. Edeleana Ges. **798 453**

Fluidised chemical processes and apparatus therefor. Compagnie Industrielle de Procedes et d'Applications Soc. Anon. **798 501**

Thermoresponsive cements. B.B. Chemical Co. Ltd. **798 686**

Decomposing sulphur and/or nitrogen compounds. Metallges, AG. **798 395**

Fertilisers. Fisons, Ltd. **798 463** **798 690**

Chromium-containing monoazo-dyestuffs and process for making them. Ciba Ltd. **798 746**

Oiling agents containing polyalkylene oxide wax derivatives, for use in the treatment of fur skins. Boehme Fettchemie Ges. **798 464**

Dyeing fabrics by means of pigments. Farbenfabriken Bayer AG. **798 437**

Purification or production of titanium. Dominion Magnesium, Ltd. **798 750**

Process for the conversion of carbon monoxide to dioxide. Baumann, F. **798 539**

Control of supply of feed-liquid to distillation apparatus. Fisons, Ltd. **798 626**

Preparation of ortho-substituted phenolic compounds. Ethyl Corp. **798 438**

Preparing a silica gel flatting agent. Grace & Co., W. R. **798 621**

Production of salts of aryloxyethanosulphuric acid half esters. Henkel & Cie, Ges. **798 476**

Primary alcohols. Imperial Chemical Industries, Ltd. **798 541**

Hydrometallurgical production of cobalt and nickel. Chemical Construction Corp. **798 478**

Preparing nitrogen-containing copolymers. Esso Research & Engineering Co. **798 542**

Manufacture of linear high polymer with urea and/or urea derivative as one component. Toyo Koatsu Kogyo Kabushiki Kaisha. **798 543**

Purification of carbon or graphite articles. Union Carbide Corp. **798 644**

Fibre-reinforced synthetic resin laminates. Mendip (Chemical Engineering), Ltd. **798 398**

Derivatives of pyrimidine and the manufacture thereof. Wellcome Foundation, Ltd. (Burroughs Wellcome & Co. (U.S.A.), Inc.). **798 646**

Apparatus for simultaneously grinding the two surfaces of a ribbon of glass. Pilkington Bros., Ltd., and Charnock, S. **798 612**

Process for the production of salts of phosphoric acids. Chemische Fabrik Budenheim AG. **798 630**

Chromium plating. British Non-Ferrous Metals Research Assoc. **798 590**

Vinyl ether derivatives and polymers thereof. Rohm & Haas, Co. **798 399**

Quaternary salts. Smith, Ltd., T. & H., Johnston, R. G., and Spencer, K. E. V. [Cognate application 26213.] **798 648**

Manufacture of terephthalic acid dimethylester. Farbenfabriken Bayer AG. **798 439**

Filling of leather. Imperial Chemical Industries, Ltd. **798 649**

Octa-alkylpyrophosphor-amides. Union Carbide Corp. **798 632**

Trisazo dyestuffs. Cassella Farbwerke Mainkur AG. **798 545**

Composite resilient materials. Dunlop Rubber Co., Ltd. **798 487**

Iminyl phosphates, their preparation and application. California Spray-Chemical Corp. **798 703**

Recovery of components of complex esters. Esso Research & Engineering Co. **798 467**

Hair-waving preparations and processes. Ashe Laboratories, Ltd. **798 674**

Making photographic packet emulsions. Kodak, Ltd. **798 512**

Carboxylic acid esters and lubricating compositions thereof. Esso Research & Engineering Co. **798 653**

Artificial filaments. Imperial Chemical Industries, Ltd. **798 422**

Quaternary ammonium compounds. National Aluminate Corp. **798 488**

Production of anhydrous fluorides. Aktiebolag Atomenergi. **798 489**

Method for chlorine recovery. Hooker Electrochemical Co. **798 576**

Manufacture of salts of terephthalic acid. Imperial Chemical Industries, Ltd. **798 442**

Aspirin. Monsanto Chemicals, Ltd. **798 633**

Manufacture of magnesia cement. Sommer, A. **798 577**

Therapeutic compositions. Biorex Laboratories, Ltd. **798 655**

Lubricants. Esso Research & Engineering Co. **798 579**

Aluminium dialkyl monohalides. Petrochemicals, Ltd. [Cognate application 33741.] **798 599**

Diagnostic compositions. Imperial Chemical Industries, Ltd. **798 443**

Polymerisation of olefins. Standard Oil Co. **798 592**

N, N¹-di-(carboxyalkylthiocarbamyl) polymethylenediamines. Monsanto Canada, Ltd. **798 516** **798 517**

Maleic anhydride recovery. Monsanto Chemicals, Ltd. **798 436**

Preparation of dichlorbutenes. Distillers Co., Ltd. [Cognate application 25976.] **798 393**

[Addition to 798 393.] **798 394**

Copolymer composition. California Research Corp. **798 437**

Coating molybdenum and its alloys. General Electric Co. **798 624**

Replacing active hydrogen by a hydrocarbon group. Abbott Labs. **798 583**

Preparation of olefinic carbonylic compounds. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **798 584**

Liquid coating compositions. Du Pont de Nemours & Co., E. I. **798 634**

Lubricating oil compositions. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **798 635**

Recovery of organic isocyanates. Du Pont de Nemours & Co., E. I. **798 636**

Extrusion of chlorotrifluoroethylene polymer. Standard Telephones & Cables, Ltd. **798 531**

Manufacture of stabilising pastes for resinous compositions. National Lead Co. **798 675** **798 464**

Recovery of platinum group metal from catalyst. Universal Oil Products Co. **798 712**

Foamed cellular alkyd resin-polyisocyanate plastic materials. Nopco Chemical Co. **798 446**

Production of aqueous dispersions of ethylene polymers. Badische Anilin- & Soda-Fabrik AG. **798 565**

Production of polymerisation products from olefinically - unsaturated hydrocarbons. Badische Anilin- & Soda-Fabrik AG. **798 447**

Process for the production of polyamides. Inventa AG. für Forschung und Patentverwertung. **798 659**

Production of quaternary ammonium polyphosphate. Imperial Chemical Industries, Ltd. **798 600**

Cold-sealing water-soluble thermoplastic cellulose ether composition. Abbey, A. (Dow Chemical Co.). **798 448**

Derivatives of pyrazole. Wellcome Foundation, Ltd. **798 662**

Production of hydrohalides of barbituric acid derivatives. Nordmark-Werke Ges. **798 666**

Organosiloxane elastomer foams. Midland Silicones, Ltd. **798 667**

Fosterite ceramic bodies. General Electric Co. **798 450**

Producing trichloroethylene from tetrachloroethane. Columbia-Southern Chemical Corp. **798 451**

Preparation of hexafluorobutadiene. Dow Chemical Co. **798 407**

Concentrating niobium minerals by froth flotation. Kennecott Copper Corp. **798 768**

Organo-siloxane elastomer foams. Midland Silicones, Ltd. **798 669**

Apparatus for separating suspended mist particles from gases. Thermix Corp. **798 409**

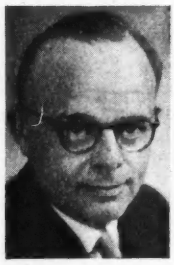
Process and apparatus for separating gas mixtures. Union Carbide Corp. **798 584**

Stabiliser for single powder photographic developer. General Aniline & Film Corp. **798 678**

People in the NEWS

● DR. R. H. MARRIOTT, D.Sc., F.R.I.C., (County Laboratories Ltd.) was elected president of the Society of Cosmetic Chemists of Great Britain, in succession to MR J. PICKTHALL, at the recent annual meeting. Other officers elected were: vice-president, DR. H. W. HIBBOTT, M.Sc., Ph.D., A.R.I.C.; hon. secretary, P. A. LINCOLN, M.Sc.; hon. treasurer, R. E. SPATE. Three council members elected were: S. J. BUSH, F.R.I.C.; R. T. DOBSON, J. B. WILKINSON, B.A., B.Sc., F.R.I.C.

● MR. A. CHENEY has been promoted sales manager of Acheson Colloids Ltd., 13 Pall Mall, London SW1, a subsidiary of Acheson Industries (Europe) Ltd. He and his staff will move shortly to the new headquarters offices of the company which are in one of the modern buildings in the new city of Plymouth. MR. G. J. B. DAVIES has been appointed general manager of Acheson Dispersed Pigments Co., Dukinfield, Cheshire. This company, which specialises in the processing of pigments into synthetic resins, plasticisers and other media, is a division of Acheson Industries (Europe). Mr. Davies was previously general manager of Acheson Colloiden N.V., Scheemda (Gr.), Netherlands. MR. EDWARD A. SMITH has been promoted assistant manager, European operations. This senior executive position carries the responsibility of maintaining efficiently all operations of the various production units of Acheson Industries (Europe) in the UK and the Continent. Other appointments are that of MR. G. F. HENDERSON as assistant sales manager, Acheson Colloids Ltd., who will continue to operate from the company's Richmond office, and MR. T. WINT, who has been appointed sales engineer for Acheson Colloids. He will be responsible for north east England and will operate from the Rochdale office.

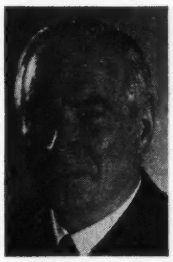


J. J. Serrell, who has been appointed to the board of Sharples Centrifuges Ltd. (see CA, p. 1213, 28 June)

● MR. A. HITTINGER has resigned from the board of Benzole Producers. He was chairman of the company from its formation in 1953 until 1955.

● SIR COLIN ANDERSON has been appointed chairman of a committee set up to consider the present system of awards from public funds to students attending first degree courses at universities and comparable courses at other institutions. Other members include: DR. D. W. LOGAN, principal, London University; DR. J. S. TOPPING, principal, Brunel College of Technology, Acton; MR. A. H. WILSON, managing director in charge of research and development, Courtaulds Ltd.

● MR. G. DRING, M.A., B.Sc., F.R.I.C., M.I.Chem.E., F.P.I., has retired from the board of Bakelite Ltd., 12–18 Grosvenor Gardens, London SW1. He will, however, continue to act as technical consultant in regard to research, patents, trade marks, etc., and will represent the company in various technical and scientific activities at home and abroad. He is chairman of the Plastics Industry Standards Committee of the BSI and a vice-president of the Plastics Institute. Mr. Dring was appointed research chemist to the Damard Lacquer Co. in 1921. Following the amalgamation of this company and Mouldensite Ltd. in 1927, and the formation of Bakelite Ltd., he became works manager at Darley Dale. Later he moved to Birmingham to take charge of the development department of Tyseley factory.



G. Dring, who retires from the board of Bakelite

● MR. L. R. G. NORFORD has been appointed associate director and joint secretary of Aspro-Nicholas.

● MR. A. W. PRENDERGAST, sales representative of Research Utilities Ltd., has been appointed a director to the board.

● The committee representing the Royal Society and the University of Sheffield has appointed MR. K. DALZIEL, B.Sc. (London), as Sorby Research Fellow from 1 October, 1958, to work in the biochemistry department of the University of Sheffield on biological kinetics.

The committee representing the Royal Society and the Armourers and Brasiers' Company has appointed DR. T. E. FABER, B.A., Ph.D. (Cantab.), of Corpus Christi College, Cambridge, as Armourers and Brasiers' Company Research Fellow from 1 October, 1958, to work at the Cavendish Laboratory, Cambridge, on the electronic properties of liquid metals.

Under the terms of the scheme to commemorate the late Lord Rutherford of Nelson the following appointment has been made by the council of the Royal Society: DR. R. C. KUMAR, B.Sc., M.Sc. (Patna), Ph.D. (London), now working at the National Research Council of Canada, has been appointed Rutherford Scholar for three years from November 1958, to carry out studies on elementary particles at University College, London.

● MR. JASPER FRANKENBURG, M.A., chairman of Greengate and Irwell Rubber Co. Ltd., was re-elected president at the annual meeting of the Federation of British Rubber and Allied Manufacturers held on 26 June. MR. H. G. W. CHICHESTER-MILES, chairman of the Empire Rubber Co. and MR. S. D. SUTTON, director and general manager of Veedip Ltd., were re-elected vice-presidents.

● MR. R. L. KENNY, chief chemist and merchandising manager, has been appointed to the board of Fuller's Ltd., London W6.

● The new board of T. C. Spray Finishing Systems (Bede) Ltd., 5 St. James's Place, London SW1, now includes MR. JAMES A. BEDE, US, and MR. G. K. SARGENT. The three other directors, T. COWLAND, R. B. Moss and A. E. MANTELL, were formerly partners in T. C. Spray Finishing Systems.

● PROFESSOR A. C. FRAZER, M.D., D.Sc., F.R.C.P., was re-elected president of the British Food Manufacturing Industries Research Association at the annual meeting in London on 26 June. He is professor of medical biochemistry and pharmacology at Birmingham University and for many years has been working on nutrition problems. Re-elected as vice-president was LT.-COL. G. R. HARDING (Aplin and Barrett Ltd.). MR. C. O. BARBER, B.Sc. (Batchelors Peas Ltd.), was elected chairman of council.

Professor Frazer, BFMIRA president (right) with Dr. Charles Hill, Chancellor of the Duchy of Lancaster, at the association's annual lunch

● To achieve a closer working arrangement between the two companies, MR. H. W. PALMER, managing director, Glaxo Laboratories Ltd., has been appointed to the board of Allen and Hanburys Ltd., and MR. C. W. MABLETHORPE, managing director, Allen and Hanburys, has been appointed to the board of Glaxo.

● The honorary degree of Doctor of Laws was conferred upon DR. D. D. PRATT, director, Chemical Research Laboratory, Teddington, and MR. G. B. B. MCI. SUTHERLAND, director, National Physical Laboratory, Teddington, at St. Andrews University on Tuesday.

LAPORTE CHAIRMAN DETAILS NEW PLANT PROJECTS

THE record capital expenditure by the Laporte group was noted in CHEMICAL AGE last week (p. 1212). Mr. L. P. O'Brien, in his statement, said that Laporte Chemicals Ltd. reached new peaks of turnover and profit, having made over a million pounds, subject to tax. Installation had been completed at Baronet Works, Warrington of the new plant to make hydrogen peroxide by a cyclic process involving the successive reduction and oxidation of an organic chemical substance. The new plant was now being put into commission, and as the large scale pilot plant at Luton was fulfilling expectations as regards rated productive capacity of high quality peroxide, it was hoped that the new plant would enable Laporte Chemicals to overtake the backlog of unfulfilled orders during this calendar year.

The electrolytic hydrogen peroxide plants were working more efficiently than ever before and could render good service for years to come. The new organic method, however, would eventually overtake the electrolytic process so far as large-scale production was concerned just as the latter had ousted the barium process.

Installation of a new and better designed sodium perborate plant had been completed at Warrington, and had ample capacity to cope with foreseeable demands from home and abroad. Also at Warrington, better designed and equipped departments had been built for production of the widening range of organic peroxides.

The next major item included and authorised in Laporte Chemicals' development programme was the design and erection of a plant for manufacture of sodium chlorite. Increasing quantities now imported into the UK were estimated to warrant the installation of a domestic plant. Laporte Chemicals state that they believe they can manufacture sodium chlorite at a competitive cost which should yield a satisfactory return on the capital outlay.

Excellent progress had been made by Laporte Titanium Ltd. The third phase of plant extension at Stallingborough for the manufacture of titanium oxide was nearing completion. This plant had been entering into gradual production in recent months. A new sulphuric acid plant at Stallingborough had also recently come into production making Laporte Titanium independent of external acid supplies.

A new chemical research laboratory was under construction which would give more scope for an intensification of research effort in producing a more extensive range of suitable qualities and types of titanium pigments and titanium organic compounds.

Reference was made to the plant to burn pyrites to make sulphuric acid which was built by Laporte Acids Ltd. at the time when there was a sulphur shortage. With the erection of the new sulphur-burning plant by Laporte Titanium at Stallingborough, Laporte Acids has been deprived of sales to Laporte Titanium. Therefore some productive capacity in Yorkshire will be dismantled, some of the smaller units being scrapped, in order to secure maximum economies.

BCURA Tests on Dolomite and Ammonia as Anti-Corrosion Additives

INVESTIGATIONS are being carried out by the British Coal Utilisation Research Association under contract with the Ministry of Power into problems associated with the production of fuel or synthesis gas in gasifiers operating at high pressures and at temperatures at which the ash is in the form of liquid slag. The aim is to evolve efficient and reliable means for producing fuel or synthesis gas from small low-rank coal. Close contact is kept with the Ministry's other gasification projects.

Major problems of gasification under pressure include the introduction of fuel into a pressure vessel and the reliable removal of slag, its quenching and depressurising. This is stated in the annual BCURA annual report (price 10s. from the liaison and publications officer, Randalls Road, Leatherhead, Surrey).

In a section dealing with the chemistry of coal, it is stated that one possible means of producing chemically-useful substances from coals is to convert them into improved ion-exchange materials. Several known aromatic substitution reactions have been applied to coals in attempts to prepare such materials; nitration, sulphonation and chloromethylation. In all cases, the required groupings were introduced, but not to the extent hoped for and some oxidation always occurred.

Dealing with deposits and corrosion in water-tube boilers, the report refers to tests carried out at Nantes-Cheviré Power Station, France, in collaboration with CEA and the Fuel Research Station to evaluate the behaviour of dolomite and ammonia as corrosion-inhibiting additives on oil-fired boilers. Dolomite injected into the furnace in the proportion of four parts of dolomite per 1,000 parts of oil, effected a small but significant reduction in the acid dewpoint. Further additions of dolomite at the inlet to the air heater effected no improvement; larger additions to the furnace were found undesirable on account of slagging. Ammonia, added at the rate of 0.6 parts per 1,000 of oil, completely suppressed the acid dewpoint, but gave rise to sticky air heater deposits which themselves were corrosive and which caused rapid blockage of the air heater.

On the development of instruments, the report states that a new design of recording dewpoint meter functioned satisfactorily for several weeks at Marchwood Power Station and that an improved model is now being built. Attention was being focused on cleaning the sensing element, which is the only obstacle to making the instrument entirely automatic. There are obvious advantages in eliminating the human error in dewpoint determination; the new apparatus also enables continuous records of dewpoints to be obtained. It should thus prove possible to monitor accurately the effect of additives or other methods of corrosion control.

Polymers Improperly Excluded from KID

The Board of Trade have received complaints under Section 1 (5) of the Safeguarding of Industries Act, 1921, that the following articles have been improperly excluded from Key Industry Duty, List J: polyethylene, polymethyl methacrylate, polystyrene, polyvinyl chloride.

Complaints will be referred to an arbitration tribunal constituted under Section 10 (4) of the Finance Act, 1926, and the date of the hearing will be announced later. Communications should be addressed to the Tariff Division at Horse Guards Avenue, Whitehall, London SW1, not later than 25 July.

TRADE NOTES

Paraffin Wax

Shell Chemical Co. have taken over the marketing of Shell's paraffin wax from Shell-Mex and B.P. Inquiries should be sent to divisional offices or to the General Chemicals Department at 15-17 Great Marlborough Street, London W1.

ICI Cut Fertiliser Prices

Imperial Chemical Industries Ltd. announce in their price list for July 1958 to June 1959 a reduction of 10s per ton in the price of their concentrated complete fertiliser.

New Pig Product

Benger Laboratories Ltd. launched a new anti-anaemia product for pigs on 1 July. Known as Imposil, it is a brand of Ferrimicrodex and contains 50 per cent more iron than the previous Benger product. With one 2 c.c. injection of Imposil each three-day-old piglet will now receive 150 mg. of iron.

Langley Alloys, Y Valves

The Y valves manufactured by Langley Alloys Ltd. to the German specification DIN 3790, which were mentioned on page 1200 in last week's issue, are Langley type 12200 and not 12000 as stated.

Guinness Lectureship in Biochemical Engineering

Arthur Guinness Son and Co. Ltd. have enabled the University College of London to establish a Guinness lectureship in biochemical engineering. It will meet the need for chemical engineers, trained in biochemistry and microbiology, for the food and beverage industries and for the growing field of antibiotics.

Commercial News

- **Aspro-Nicholas Plan Large Capital Rise**
- **Capital Spending by Boake Roberts**
- **Greeff Earn More Despite Lower Margins**
- **New Holding Company for Triplex Group**

Aspro-Nicholas Expansion

Aspro-Nicholas propose to raise their nominal capital to £2 million by the creation of 2 million 5s ordinary shares. This decision has been taken by the board having regard to the continuing progress and expansion of activities and the desirability to have ready facilities for further issue if and when the necessity arises.

It was announced that the company intended to expand activities in the US market and negotiations were taking place with Nicholas Proprietary of Melbourne, Australia (an associate company) on the basis of joint ownership of a company to be formed in Canada.

Group taxed profit attributable to the company rose from £261,689 to £291,169 and dividend is being maintained at 24 per cent. Payments on the new Bath Road, Slough, factory amounted to £537,000 during the year and up to the end of the period 90 per cent of the total cost had been paid.

A. Boake Roberts

The directors of A. Boake Roberts and Co. Holdings state that apart from serious international disturbances, they believe that trade generally is likely to be maintained at current levels. Mr. F. G. Pentecost reports that production costs, apart from raw materials, are still rising and in the prevailing conditions competition compels reduction in profit margins of many of the group's products.

Providing trading conditions remain normal during the coming year, interest of £48,000 on borrowed money for the development, and cost of depreciation, is expected to be recovered from increased sales from new plants. Some £790,000 was spent during the year ended 30 March, 1958, of which £586,000 was for the new site at Widnes. Capital commitments of £130,000 relate to actual orders placed for plant and equipment and the group's capital budget for the current year is planned on capital expenditure of about £400,000.

Group profits, as reported last month (CHEMICAL AGE, 14 June, p. 1124), rose from £226,381 to £352,104. The dividend remains at 15 per cent.

H. J. Enthoven

In his annual report for the year ended 31 December 1957, the chairman of H. J. Enthoven and Sons Ltd., Mr. A. M. Baer, regretted having to report that the consolidated loss after providing for all charges including interest and depreciation amounted to £156,334. Of this total a sum of £27,952 was attributable to the subsidiary Chemidus Plastics Ltd. The major factor which had led to the disappointing results of the parent company was the steep decline in prices of non-ferrous metals during the year under review.

During the year under review 75 per cent of the company's share and loan capital in Pure Chemicals Ltd. was sold. Mr. Baer said the company had also received in February this year an offer for the remaining 25 per cent from the purchasers, which offer the board had decided to accept. The total sum realised was £275,000.

Chemidus Plastics Ltd. had incurred a substantial loss due to continuing development expenditure and production difficulties. Fair progress had, however, been made in the marketing of products for use in the chemical industry and sales to it were expected to increase in 1958.

Edwards High Vacuum

Treasury consent has been obtained by Edwards High Vacuum to a proposed issue of £450,000 convertible unsecured loan stock. Final terms are still under discussion. The stock is to be offered to ordinary holders by way of rights.

For the increase in capital necessary to provide a reserve of ordinary shares to cover the conversion rights, it is proposed to create 1 million new 4s ordinary shares.

Goodlass Wall

Losses in the traditional field have been made up by new developments throughout the Goodlass Wall and Lead Industries' group, chairman, Mr. R. L. H. Lancaster reports. New products in a state of development include zirconium compounds, calcium plumbate pigments and an increasing range of chemicals for the plastics industry. Production of lithium carbonate and lithium hydroxide is now firmly established and there is a steady increase in business in these products.

Johnson Matthey

An unchanged dividend of 7 per cent is being paid by Johnson Matthey and Co. Ltd., making a total of 10 per cent for the year to 31 March, 1958, as previously. After a lower UK tax charge of £789,853 against £871,207, grand profit is £934,492 compared with £945,498. Profit balance attributable to the holding company is £890,539 (£916,335).

Greeff-Chemicals

Reference was made to the record turnover of Greeff-Chemicals Holdings by chairman, Mr. S. Bayliss Smith at the annual general meeting. Profit of the group increased despite lower margins and greater overhead expenses, from £128,034 in 1956 to £186,163 in 1957. A bonus of 4 per cent in addition to the final dividend of 11 per cent has been recommended. Total distribution for the year amounts to 19.54 per cent on present ordinary capital.

A private placing of £100,000 6½ per cent unsecured loan 1972/82 was effected early last year and was used to take up 89,290 £1 shares of British Titan Products at par. A further 89,290 shares have been taken in this company as a result of British Titan's November 1957 issue. To finance this, 200,000 5s shares were issued at 10s per share yielding £100,000.

The chairman warns that although turnover in the current year exceeds that of the corresponding period of last year, any falling off at home or abroad in any one or more industries with which the company is concerned, could affect results adversely.

Morgan Crucible Co. Ltd.

A slight drop in the 1957-8 sales volume, though not value, has been reported by the chairman of Morgan Crucible Co. Ltd. Capital expenditure last year decreased from approximately £1,450,000 to £950,000, though the accounts show an increased provision for depreciation. Company exports still prosper, in spite of shrinking world trade.

Nuclear Graphite Ltd.* (a company in which Morgans are associated with AEI-John Thompson Nuclear Energy Co. Ltd.) are expected to start machining high purity graphite for nuclear power plants in October. Other carbon components for nuclear reactors are being produced and expansion in this field is anticipated. Morgans have undertaken to subscribe £200,000 to the working capital of Nuclear Graphite Ltd.

*Nuclear Graphite will take over the Royal Ordnance Factory, Poole, on 1 October.

Wm. Neill

A warning not to expect profits to be comparable with those of the past two or three years has been given by the board of Wm. Neill and Son (St. Helens), industrial, chemical and structural engineers. Reference is made to keen competition and rising costs. In the year ended 31 March 1958, the net balance, including £20,000 (nil) unrequired tax, of £164,862 compared with £166,570. Current assets are reduced from £1,011,038 to £993,181. The dividend remains at 33⅓ per cent.

Triplex Group

On 1 July Triplex Safety Glass Co. Ltd. changed its name to Triplex Holdings Ltd. The holding company will in future control the investments in the subsidiary companies. These companies include Quickfit and Quartz Ltd., Stone (Staffs); Q.V.F. Ltd., Fenton, Stoke-on-Trent; Weldall and Assembly Ltd., Stourbridge; Stern and Bell Ltd., Birmingham; Charles S. W. Grigg Ltd., Hounslow, Middx.; and Triplex (Northern) Ltd., Eccleston, St. Helens, which now becomes Triplex Safety Glass Co. Ltd. and will also control the factories at King's Norton (Birmingham) and Willesden.

The board of Triplex Holdings Ltd. will initially be: Sir Graham Cunningham, K.B.E. (chairman); Mr. J. D. Nuttall,

A.C.A. (financial director); Mr. Arthur C. Pilkington; Sir Harry Pilkington, J.P. The board of the new Triplex Safety Glass Co. Ltd. will have as members six former directors of the old company of the same name (including Dr. A. C. Waine, Ph.D., as research director) and three new directors.

Vokes Ltd

Manufacturers of air and oil filters and silencers, Vokes Ltd., have agreed to acquire all the 24,000 issued £1 ordinary shares and the 1,000 employee 1s shares of Robert Kellie and Son of Dundee; against the allotment of 300,000 ordinary 4s shares of Vokes.

A final distribution on the ordinary capital as increased for the year to 30 June 1958 is forecast as not being less than 17½ per cent final rate for 1956–57, which included a 5 per cent bonus. An unchanged 7½ per cent interim has already been paid.

Woodall-Duckham Ltd.

At the annual meeting of Woodall-Duckham Ltd. group profits before tax of £1,264,938 for 1957-8 were announced (£1,087,064). Group net profit was £609,836 (£520,756). Although the value of work done in 1957 (i.e. over £15 million) exceeded the orders received during that year by about £3 million, the group had about £22 million of unexecuted work in hand at the end of 1957.

Last year Woodall-Duckham Construction Co. Ltd. was occupied in the building of a number of new and reconstructed coal carbonisation plants for the gas industry. Because of this industry's present interest in high pressure processes, the company has formed a High Pressure Processes Division. An agreement has also been entered into with Pintsch Bamag of Butzbach, Germany, to build gas treatment plants for high pressure gases. Projects for such plant are in hand.

W. J. Jenkins and Co. Ltd. have again increased their volume of orders, including some for speciality plant for the process handling of fertilisers, sinter, etc.

NEW COMPANIES

GLAZEBROOK AND CO. (LONDON) LTD. Cap. £3,000. Importers and exporters of and dealers in chemicals, fertilisers, etc. Reg. office: 110 Cannon Street, London EC4.

SARAH KIRKUP (PONTELAND) LTD. Cap. £5,000. Consulting, analytical, manufacturing, pharmaceutical, and general chemists, etc. Directors: S. Kirkup, L. Kirkup, J. Kirkup and D. E. Vannan. Reg. office: Savings Bank Chambers, Market Place, Morpeth, Northumberland.

INDUSTRIAL GERMICIDES LTD. Cap. £1,000. To acquire the business of a manufacturing chemist carried on by George H. Muddimer at 10 Central Avenue, Leicester; to carry on the business of manufacturers of and dealers in pharmaceutical and chemical preparations, fertilisers, chemical and other manures, germicides, insecticides, fungicides, etc. Directors: G. H. Muddimer, G. R. Goodman and M. R. Howe. Reg. office: 224 Humberstone Road, Leicester.

PITCHMASTIC AND ASPHALT (MANUFACTURING) LTD. Cap. £10,000. To distil, deal with, manufacture and render saleable coal tar, pitch, asphaltum and other residual products obtained in the manufacture of gas, etc. Subscribers: R. H. Preston and Mrs. G. Preston. Reg. office: South Street, Ilkeston.

RESYN (PHENOLICS) LTD. Cap. £2,500. To carry on the business of manufacturing, research, dispensing and analytical chemists and druggists, etc. Directors: A. J. Buck and Mrs. M. E. Buck. Reg. office: 'Newland', Parker Lane, Mirfield.

INCREASES OF CAPITAL

IMPERIAL CHEMICAL INDUSTRIES LTD., Imperial Chemical House, Millbank, London SW1. Increased by £130,000,000 beyond the registered capital of £220,000,000.

C. TENNANT, SONS AND CO. LTD., 4 Copthall Avenue, London EC2. Increased by £10,000 beyond registered capital of £570,000.

CADULAC CHEMICALS LTD., The Bridge, Radcliffe, Lancs. Increased by £10,000 beyond the registered capital of £5,000.

Price's Introduce New Stearine Range

A NEW range of stearines of superior quality and high chemical stability is announced by Price's (Bromborough) Ltd., Bromborough Pool, New Ferry, near Birkenhead. These stearines are marketed under the trade name Pristerene. The range is composed of Pristerene 61, 62, 63, 64, 66, 67, and Stearic Acid B.P.C. Technical bibliography on the new range is available detailing specification, typical composition, suggested uses, physical form and packaging.

In addition to the traditional flake powder and block, a new physical form has been introduced—Pristerine beads. In this form stearine does not dust or cake, and is specially recommended for fluidised handling.

Applying Cibacron Dyes to Wool

Following extensive experiments and bulk trials Ciba Ltd., Basle, state they have succeeded in developing a simple method of applying Cibacron dyes to wool. Essential features of the method, for which patent applications have been made, are that dyeing is carried out at a pH of 4-5 in the presence of Neovadine AN or AL. The general procedure is given in *Ciba Review*, No. 126.

New Plant for Scottish Tar

Scottish Tar Distillers, Ltd., are planning the early erection of a tar acid distillation plant at Lime Wharf Chemical Works, Camelon, Falkirk, Scotland, at an estimated expenditure of £14,500.

Market Reports

DEMAND FOR TEXTILE CHEMICALS SLACKENS

LONDON There have been no important changes on the industrial chemicals market in prices or conditions. The movement, in the aggregate, has been fairly substantial, although there has been some seasonal slackening in the demand for textile chemicals, and the market for agricultural chemicals is less active. The volume of export enquiry has been satisfactory for the period, with buyers seeking keen quotations. Business on the coal-tar products market has been quiet with prices steady.

MANCHESTER Seasonal conditions arising from the holidays are exercising an additional restrictive influence on business in heavy chemicals here and also on contract deliveries, especially regarding the wide range of textile chemicals. Sellers report an increasing disposition on the part of consumers to limit fresh commitments to shorter delivery periods than has been experienced for some considerable time. This arises from the state of their own order-books in many instances, coupled with the hope that prices may tend in their favour. Fertiliser materials are seasonally quiet, while the leading tar products are showing a fair amount of movement.

GLASGOW Despite the unfortunate 'laying off' of personnel in some industries due to adverse trading conditions, the increased demand for a wide range of chemicals experienced last week has been maintained, and generally speaking a good week's trading can be reported in the Scottish market. There have been no significant price changes, although the trend has been upwards. This trend has not greatly surprised buyers since a number of manufacturers have been absorbing price increases in labour and materials, etc., for a long time, and it was expected certain increases would have to take place.

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